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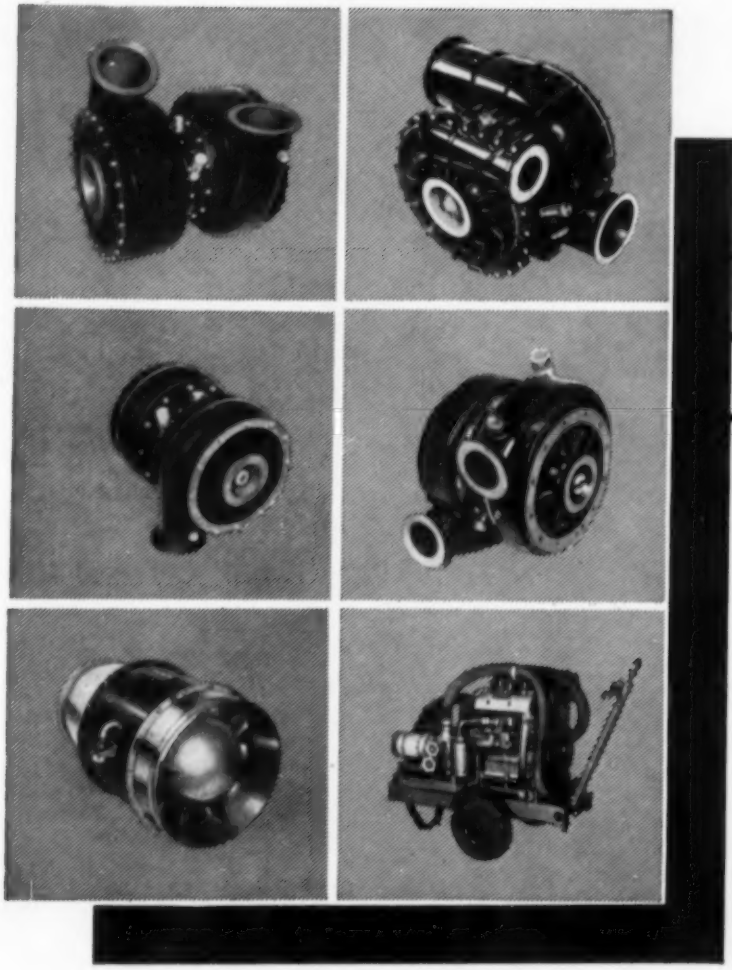

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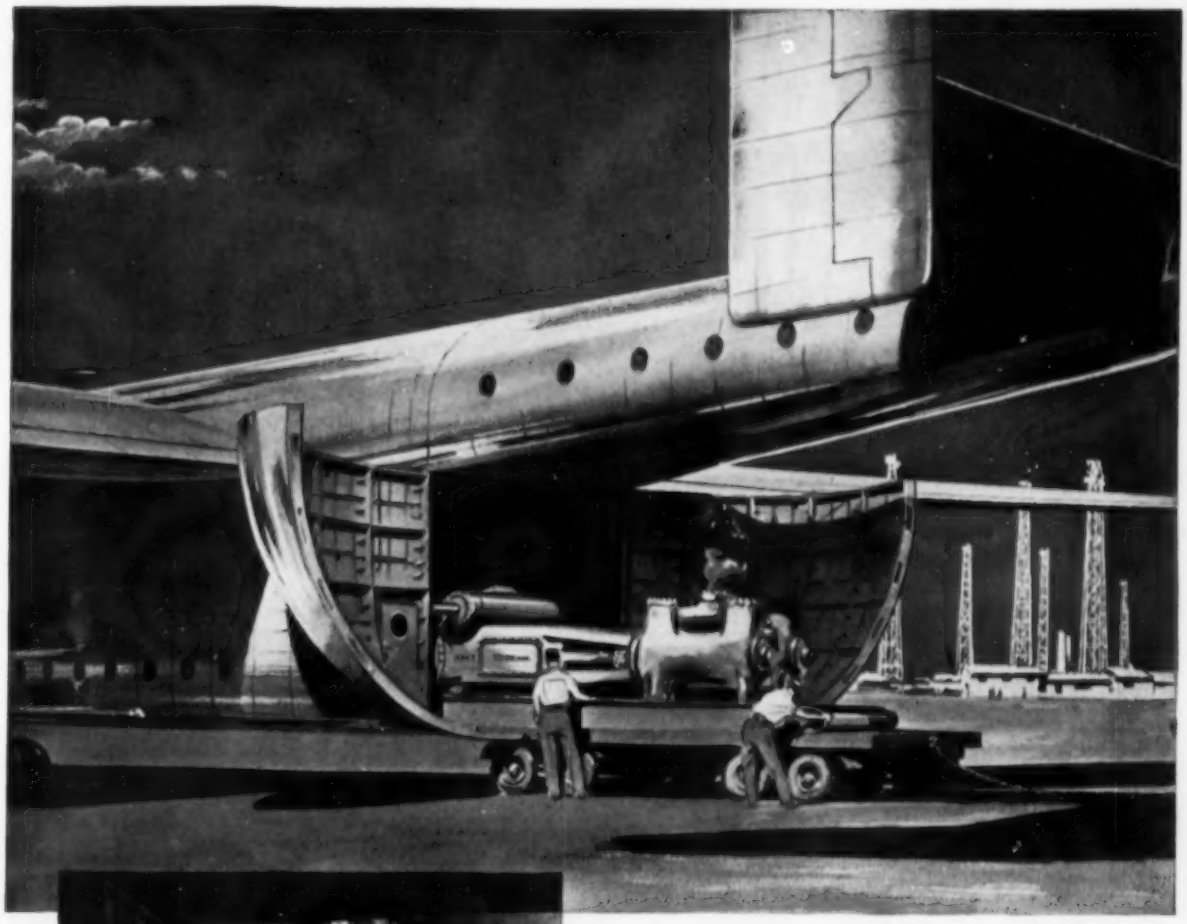

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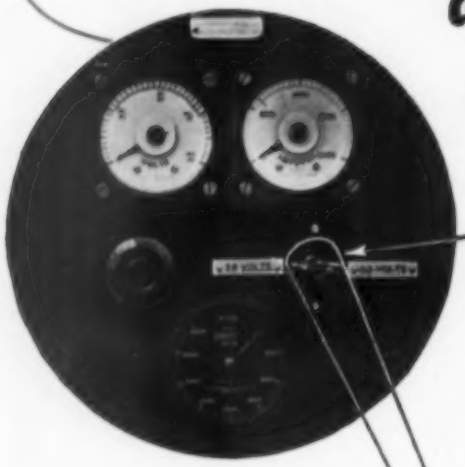

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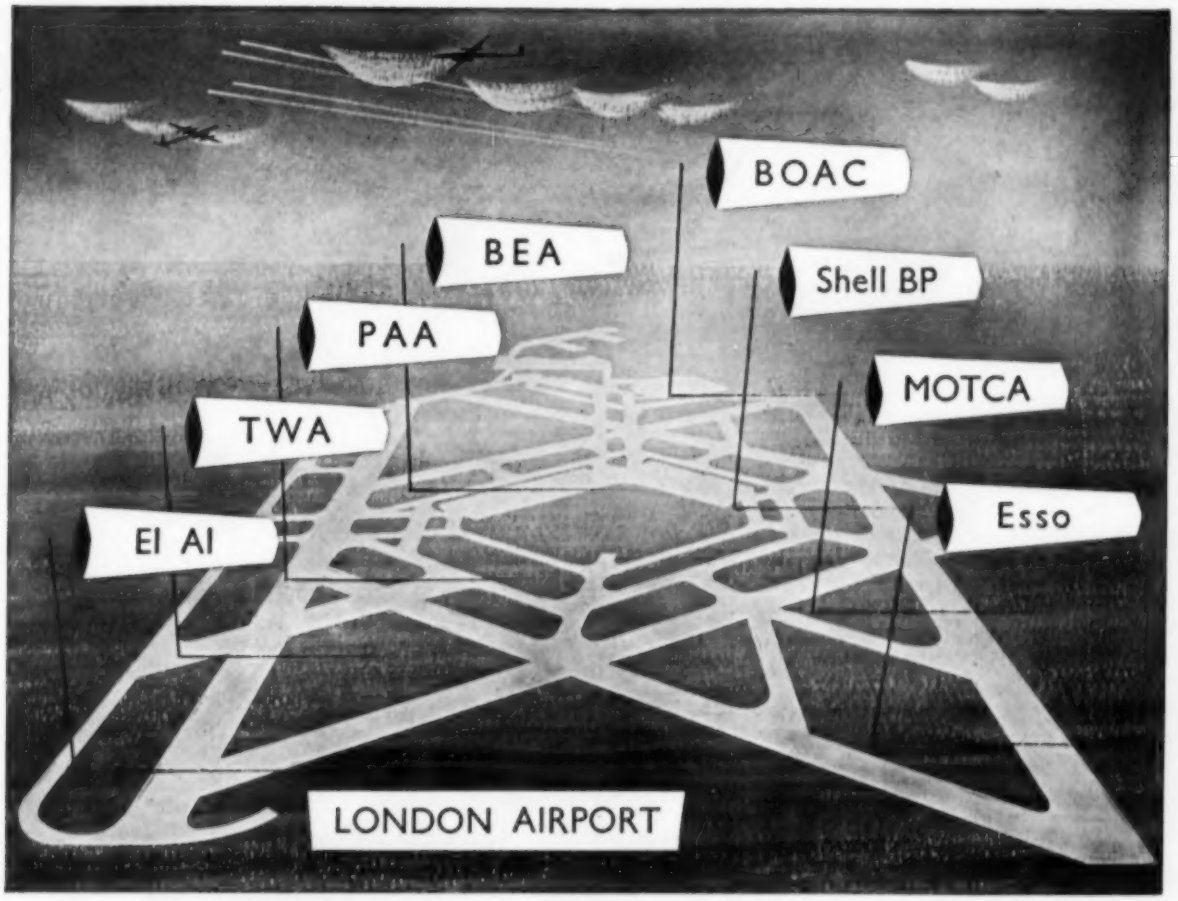

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Stormy Weather

SEVERE turbulence was encountered in Parliament earlier this year by the White Paper *The Supply of Military Aircraft*, when Mr. George Wigg challenged the statement that our night fighter defences were the world's best. What type of British night fighter, demanded Mr. Wigg in the wisdom of his briefing, was capable of equalling the performance and fire-power of America's F-86D? To which Mr. Selwyn Lloyd replied, with all Ministerial rectitude, that it would be wrong to make a comparison between British and American aircraft which would involve secret matters. In any case, he observed, the F-86D was a single-seater night fighter, and we in Great Britain did not use this class of machine. And he clinched the argument by stating bluntly that he did not believe that the single-seat night fighter could operate "in the climatic conditions of this country."

Whether Fighter Command would support the ex-Minister's view with conviction and unanimity we may only surmise; but quite beyond conjecture is the presence at Manston, Kent—confirmed by pictures in our April 15th issue—of U.S.A.F. F-86Ds. These fighters are officially classed as all-weather intercepters, and they are operating here (though the fact is not widely appreciated) under the control of Fighter Command itself. So the Command must by now have formed some idea of the F-86D's abilities; and if, as Mr. Lloyd contended, these are inadequate for "the climatic conditions of this country," then no doubt our visitors will get airborne without delay, switch on their afterburners and head for more congenial climes.

For the present, it must be admitted, they appear curiously unaware of the shortcomings of their aircraft, and fly quite happily to the most stringent weather minima in pursuance of duties which involve the not inconsiderable matter of the air defence of Great Britain.

It is our own view—based upon demonstrated performance—that the F-86D is a very remarkable technical achievement and a highly effective weapon; in brief, a very welcome migrant to these shores. By this we do not concur in the doctrine (quite widely held in America and on the Continent) that the two-seater all-weather fighter should forthwith be discarded in favour of the pilot-monitored, semi-automatic, rocket-armed, one-man formula, as realized in the F-86D and newer American prototypes. We stand firm in our belief that, in the Javelin and its derivatives, the free nations will find a natural successor to such fighters as the Northrop Scorpion and Avro Canada CF-100, and to the shorter-ranging, more lightly armed A.W. Meteor and D.H. Venom. By its very nature the Javelin must score over the American single-seaters in its ability to intercept at great distances from its base—a point which, we may suppose, has not been wholly missed by the American Services, though they themselves are not known to be developing any such fighter.

Collision Course

Until air-to-air guided missiles are generally issued to all-weather fighter units, the U.S.A.F. is standardizing on the 2.75in Mighty Mouse folding-fin rocket, delivered in salvo on a collision course with (as described in detail on page 549) the indispensable aid of Hughes fire-control gear. While British aversion to this type of armament may have some foundation, it is clear from a public utterance by General Benjamin W. Chidlaw, Commander of the U.S.A.F. Continental Air Defence Command, that the U.S.A.F. has not regretted its choice. Having recalled the resistance put up when it was decided to convert the great Yuma, Arizona, gunnery centre into a rocket range, the General reported that results achieved there had given impetus to the Mighty Mouse programme and had actually "led collision-course firing forward a full year." In the not-too-distant future, he forecast, all but a few U.S.A.F. intercepters would be rocket-armed. So, too, it might be added, will Canada's all-weather CF-100 force be equipped to meet the Northern threat. And the presence of three of these fighters at the Central Fighter Establishment now affords Fighter Command first-hand experience of a notable American technique.

FROM ALL QUARTERS

Queen Mother Visits Her Squadron

LAST Saturday Queen Elizabeth the Queen Mother, as their Honorary Air Commodore, visited Nos. 600 and 2600 (City of London) Squadrons at Biggin Hill. She flew from Smith's Lawn, Windsor Great Park, to Biggin Hill in an S-55 of the Fleet Air Arm, making her first helicopter flight.

Her Majesty was received by A. V-M. H. L. Patch, A.O.C. No. 11 Group. Later she reviewed a parade of both squadrons and watched a formation fly-past of No. 600 Sqn. aircraft and a demonstration of Bofors gun-drill by No. 2600 Sqn. She then took tea with the squadrons and afterwards visited the station's Chapel of Remembrance, where she inspected the Battle of Britain Roll of Honour. Returning in the S-55, Her Majesty was back at Windsor three hours after leaving there.

Helicopters for the Queen's Flight

RECENT weeks—and news of events to come—have demonstrated unmistakably that helicopter travel has received the approval of the Royal Family. Though no official announcement has yet been made, it is understood that a trio of rotating-wing aircraft are shortly to be added to the Queen's Flight (which at present consists of three Vikings, about to be joined by a Heron; and it is believed that a requirement has been written for a Royal Viscount—the first official step towards obtaining this type for the Queen's Flight).

No information is available as to the types of helicopter, but it is said that one will be a WS-55 Whirlwind and another a Dragonfly. Various machines are under evaluation at the moment.

Two days after her S-55 flight, referred to above, the Queen Mother flew in an S-51, this time to Tidworth for a Colour presentation ceremony. The Duke of Edinburgh, as is well known, has been using one of these aircraft regularly during the past few months; last week (as related on page 542) he travelled to Duxford, from Windsor, to visit Aero Research, Ltd. On Monday last he flew from Windsor to Portland. On June 4th he will travel by helicopter to Eastbourne for the annual conference of the R.A.F.A., of which he is president.

It will be recalled that Princess Margaret flew in a Whirlwind during her recent tour of Western Germany and that the Duke and Duchess of Gloucester have also used helicopters.

C.P.A. and the Comet

PRESIDENT of the first overseas airline to order Comets, Mr. W. G. Grant McConachie still believes firmly in the future of the type. He stated last Friday that his company, Canadian Pacific Airlines, are considering a multi-million-dollar order for Comet 4s.

For delivery in 1958 (a "satisfactory" date, said Mr. McConachie), the aircraft would be used on C.P.A.'s new Polar route between Vancouver and London and on the westward extension to Tokyo. The C.P.A. president said that Comets would reduce journey-time between Vancouver and London to ten hours.

Mr. McConachie added: "We are thoroughly convinced that the Comet will fly again, and that from its difficulties and from research that never stopped, it will be a far better aircraft." He was speaking in London shortly before the return to Vancouver of the C.P.A. DC-6B chartered by a Canadian trade delegation for a preview of the Polar route. Scheduled services will begin in June.

It can now be confirmed that de Havillands have reached an advanced stage of progress with the Comet 4; the work of engineering the design for production is already under way. Estimated performance data for the Series 4, based on the measured performance of the Comet 3, are being supplied to airline operators, and it is expected that the figures will shortly be available for publication. The Comet 3, incidentally, is being regularly and intensively test-flown from Hatfield. A test-fuselage of the strengthened "Transport Command" Comet 2 is now being prepared for tank-testing—probably at Hatfield in a tank of D.H. construction.

Igor Sikorsky Here

ONE for whom the claim is made that he is the only man to have pioneered in the three different aeronautical fields of multi-engined aircraft, trans-oceanic flying-boats and helicopters arrived in England last Saturday. He is Igor I. Sikorsky, engineering manager of the Sikorsky Aircraft division of United Aircraft, and he is here to receive the James Watt Medal of the Institution of Mechanical Engineers, to be presented today, April 29th.

In a statement made at a London meeting shortly after his arrival, Mr. Sikorsky stressed that the helicopter was "a universal transport with which no other vehicle could compete." It had no limitations as to terrain or the bulk of goods it could lift, but it was never likely to be very fast, or suitable for long-range work. Big helicopters were already fully feasible, but a job that might take one day on a small helicopter must be expected to take a week on a large one.

Speaking of helicopter power units, Mr. Sikorsky said that, for three to five years yet, piston engines with mechanical transmission would continue to offer the most advantages. Gas turbines, also with mechanical transmission, would be better still; they would be lighter and smoother and for such a short-range vehicle high fuel consumption was less of a problem. Configurations were unlimited, but the single-rotor type would predominate and be the equivalent of the monoplane (as compared with biplanes and triplanes), and for essentially the same reasons.

The first characteristic of a good helicopter was excellent hovering—and for this condition wings and additional power sources were all dead weight. The pure helicopter probably never would fly faster than 200 m.p.h., because the retreating blade stalled at high speed; and for this same reason extra support for the aircraft was sought in some designs. Mr. Sikorsky thought that such machines with greater speed still had only limited applications—mainly military—and that the convertiplane had poor hovering characteristics as compared with the pure helicopter.

He agreed that the question of interference between the rotor blades and fixed-wing surfaces in their downwash was a problem, and a specific means for its solution must be found. The fixed wings might even require to be folded or turned to a position of minimum resistance, i.e., feathered in the downwash for hovering.

On an historical note, in answer to a question, Mr. Sikorsky said that he believed that Bréguet made the first helicopter which could become airborne; this was in 1907. His own machines in 1909 and 1910 were "very fine except for one thing—they couldn't fly." The first really practical helicopter, in his opinion, was the German Focke-Achgelis of 1937. His own design of 1939 was, he believed, the first successful single-rotor helicopter and the first machine to fly successfully in the Western Hemisphere.

The R.N.L.I. and Helicopters

HELICOPTERS were very much in the news last week. They were, for example, discussed in Glasgow by Col. Burnett Brown, secretary of the Royal National Lifeboat Institution. He was replying to a suggestion by Admiral Sir Frederick H. G. Dalrymple-Hamilton, made at a Glasgow Council meeting of the

ROYAL ARRIVAL: Queen Elizabeth the Queen Mother arrives at Biggin Hill from Windsor in a Naval S-55 (see first news item above). This was her first experience of helicopter flying.

"LAUNCHED" on April 21st, France's Caravelle twin-Avon transport is rapidly approaching the flight stage. The nose may appear familiar; so it may be added that the whole forward fuselage, with flight deck, is identical with that of the Comet. A full description of this unusual machine will be published shortly in "Flight."

Institution, that in the light of recent successful rescues helicopters might have to be provided for the Lifeboat Service.

Col. Burnett Brown said: "We are very much alive to the helicopter's possibilities, and we have appointed a special committee to keep us in touch with the latest developments."

He went on to say: "At present we have a useful arrangement whereby Royal Naval and Royal Air Force helicopters are called when required by the coastguard," and added that helicopters were "expensive to operate and unable to cope with certain kinds of work."

While agreeing that they are at present expensive both in initial and in operating cost, *Flight* feels that their importance for rescue work of many different kinds has been demonstrated so frequently during recent years that their official adoption for civilian duties of this kind should now be given the most serious consideration.

Certainly the helicopter is unable to compete with the lifeboat in certain kinds of work—at night for instance, or in rescuing a large number of survivors—but against this must be set such advantages as the extraordinary speed with which it can reach vessels or persons in distress and the fact that, unlike the lifeboat, it can also effect rescues on land (a recent example was a helicopter's attendance when a lightplane pilot crashed on a lonely moorland). Such achievements by rotorcraft, together with the fact that they already have been found useful for police purposes, suggests that, for a start, shared use by the R.N.L.I. and the police might well make economical operation possible. It no longer seems right that dependence should be placed on voluntary Service help, however speedy and efficient the helicopter aid they can usually provide.

Einstein and Aeronautical Engineering

IT is not generally known that the great physicist whose death occurred last week was at one time actively interested in aeronautical design. In about 1915-1916, in connection with his war duties at the Kaiser Wilhelm Institute near Berlin, he undertook some work on a theoretically developed aerofoil section for biplanes which, according to Einstein's mathematical research, would give improved performance and stability.

The Luft-Verkehrs-Gesellschaft (L.V.G.) at Johannisthal, of which Franz Schneider was technical director, designed an experimental biplane (the D.9V) in accordance with the mathematician's recommendations. It flew, but expectations were not fulfilled—possibly the basic design was unsatisfactory—and the development of the new aerofoil section was not pursued. A contributory reason for the abandonment of the project may have been that Franz Schneider soon afterwards left L.V.G. in order to embark upon an aircraft enterprise of his own.

R.A.F. in Dutch Liberation Celebrations

FIVE Lincolns of No. 7 Sqn, Bomber Command, are to take part in the celebrations in connection with the tenth anniversary of the liberation of the Netherlands which are being organized by the Municipality of The Hague today, April 29th. They are to fly over The Hague and drop tulip-heads and leaflets containing messages of goodwill. This is to symbolize the dropping of food by the Royal Air Force which began on April 29th, 1945, to relieve the starving Dutch citizens during the final stages of the Occupation. The Germans had agreed to allow the aircraft unimpeded passage over the area. Bomber Command aircraft made 3,341 sorties and delivered 6,685 tons of food.

Over The Hague the Lincolns will be escorted by F-84s of the Royal Netherlands Air Force and a squadron of Meteors from the 2nd T.A.F.

After dropping the flowers and leaflets the Lincolns will land at Valkenburg airfield and the crews will be the guests of the Burgomaster and aldermen of The Hague. Soon after landing, a ceremony will take place at The Hague town hall, when the captains of the aircraft will hand over special messages of friendship. These will be from H.R.H. The Duke of Edinburgh to H.R.H. Prince Bernhard; from Sir Winston Churchill to Dr. Drees, Prime Minister of the Netherlands; from Lord De L'Isle and Dudley, Secretary of State for Air, to Mr. Staf, the Netherlands Minister of Defence; from the Lord Mayor of London to the Burgomaster of The Hague; and from Lady Thurso, wife of the Secretary of State for Air who ordered the original operation, to Mrs. Louwes, widow of the Dutch official who organized the whole plan for food dropping in 1945.

Beech Acquire Morane-Saulnier Licence

THE Beech Aircraft Corporation have announced that they are to build the Morane-Saulnier M.S. 760 Paris under licence in America, thus extending its present line of light executive aircraft by the addition of the world's first four-seat jet executive aircraft. This news is foreshadowed on page 553 (which went to press earlier) wherein is described a visit to the Morane-Saulnier factory.

Beechcraft statements describe the Paris as "an amazingly fast, new four-place airplane, something that has never been offered before and cannot be duplicated by anybody at this time." The company plans to demonstrate the Morane-built first prototype all over the United States this summer. The aircraft is at present being evaluated by the French *Centre d'Essais en Vol* at Brétigny.

Among the advantages that Beech claim for the Paris are a cruising speed a little higher than that of the DC-7, a visibility "never before achieved in any aircraft of this type," full pressurization and air conditioning, a range of close on 1,000 miles, "unequalled" flying qualities, and a significant development potential, particularly in the power and fuel economy of the engines, which will be Continental-built Marboré IIs.

Canada and the Vulcan

THE suggestion has been made, in at least two Canadian journals—*Canadian Aviation* and the *Financial Post*—that the Avro Vulcan may be built in Toronto by the Hawker Siddeley Canadian partner.

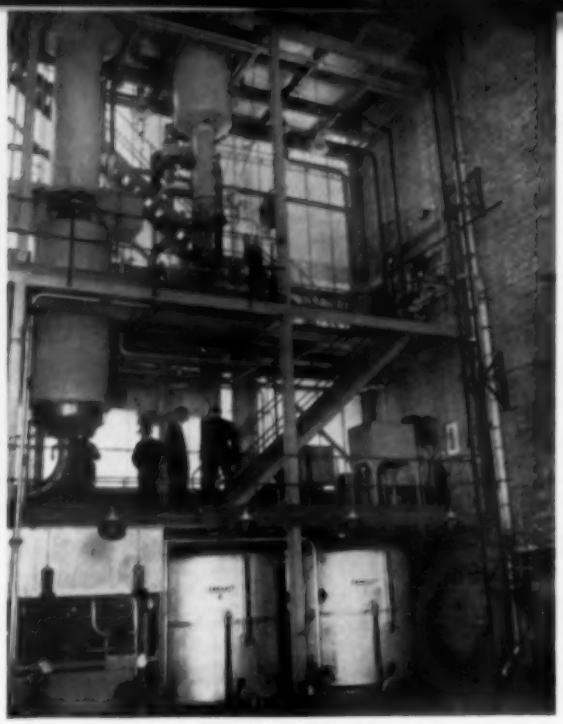
The Manchester firm had no comment to make on these reports; but any such development would be surprising, for it is understood that the company are well up on schedule with Vulcan production and that there is no need to look for further productive capacity; and it is thought that the Canadians themselves would have no call for bombers of this type. In any case, the decision to build Vulcans in Canada would have to be taken by the Canadian Government.

Independent Viscounts and Herons

AT last there are signs of slow but positive improvements in the equipment of British independent airlines. An important step in this respect will be the introduction of Viscounts, on June 13th, on the domestic and international network of Hunting-Clan Air Transport, Ltd. From Newcastle, focal point of the airline's "northern network," Viscounts will fly to Amsterdam, Dusseldorf, Stavanger and Oslo; at peak periods they will also be operated in place of Vikings on the London-Newcastle route.

Following delay in the delivery of H.C.A.'s Viscounts, the company has arranged with Dragon Airways, Ltd., for the use of the latter company's new Herons on the internal services linking Newcastle with Manchester and Glasgow. Herons will also operate from Newcastle to Hamburg and Copenhagen.

Based at Speke, Liverpool, Dragon Airways are the second British airline to re-equip with Herons (Jersey Airlines bought their first two years ago). Dragon's first Heron, G-ANYJ, was due for delivery this week, and a second will follow in June. During the coming summer Herons and Rapides of Dragon Airways will operate an extensive network of scheduled services, including week-end flights from Stoke-on-Trent to the Channel Islands and the Isle of Man—the Potteries' first air services.



THE DUKE AT DUXFORD: Having arrived in the S-55 seen in the background, the Duke of Edinburgh is conducted to the Aero Research factory (see news item below) by Mr. Raymond Needham and Dr. N. A. de Bruyne. On the right he is inspecting the impressive plant in which the formaldehyde constituent of Aerolite glue is made.

FROM ALL QUARTERS . . .

Royal Visits to the Industry

FORMED in 1934 mainly to investigate new materials for aircraft structures, the firm of Aero Research, Ltd., is now celebrating the 21st anniversary of its foundation. A commemorative exhibition has been organized at the Duxford, Cambridge, works, and on Wednesday of last week it was inspected by a distinguished visitor in the person of H.R.H. the Duke of Edinburgh.

Arriving from London in a Naval S-55, as seen in the photograph above, the Duke was met by Mr. Raymond Needham, Q.C., the company's chairman, Dr. N. A. de Bruyne (managing director) and Mr. R. G. F. Lea (commercial director).

The tour of the works which followed included an inspection of the Aerolite urea-formaldehyde glue factory, the research laboratories and the Redux department, where the royal visitor saw the bonding of honeycomb floor panels for the Fokker Friendship and of various components for the Bristol Britannia and Fairey Rotodyne. He also saw a convincing demonstration of the strength of Redux when an Aston-Martin car weighing 30 cwt in its cradle was suspended from a 3¼ sq in metal-to-metal bonded joint.

We understand that the Duke asked a number of very pertinent questions, many of them clearly based on his practical knowledge of aircraft. Before he left for Windsor he offered Mrs. Needham and Mrs. de Bruyne a short flight in the S-55, and watched them take off and return.

On the previous day the Duke had paid a surprise visit to the Bracknell, Berks, factory of Racal, Ltd. He was met by the joint managing directors, Mr. R. F. Brown and W/C. G. C. Cunningham, O.B.E., and introduced to the technical director, Mr. M. I. Forsyth-Grant, and the sales director, Mr. D. W. Morrell.

The Duke then made an informal tour of the factory and laboratories and showed considerable interest in many of the projects now being undertaken—in particular, certain restricted devices which are being developed for the British Armed Services and which are the first of their kind to be manufactured in the world. Other equipment which he inspected included a communications receiver claimed to have an exceptionally high degree of stability and tuning accuracy; high-speed electronic counting devices; and special V.H.F. aerial systems for multi-channel radio-telephone links, mainly in the Commonwealth.

Yet another firm in the industry was visited by the Duke when, on Friday last, April 22nd, he spent four hours with the M.L. Aviation Co., Ltd., White Waltham, designers and makers of a wide variety of special-purpose aircraft equipment, including air-conditioning units. His Royal Highness lunched with the chairman and directors.

CHEERFUL ARRIVAL, at Avro's Woodford works, of Air Marshal C. R. Slemon, R.C.A.F. Chief of Air Staff. On the left is Sir William Farren (Avro technical director), on the right Sir Roy Dobson (managing director) and in the background W/C. W. L. Gillespie, executive assistant to the C.A.S.

Ypenburg's Big Day

OVER ten nations have now, it is stated, promised support for the Royal Netherlands Aero Club's "Ilsy 5" air display at Ypenburg on Whit-Monday, May 30th. The organizers' latest progress report is full of enthusiasm, as the following passage will suggest:—

"The skies will resound with the notes of a full range of ultra-modern fighter aircraft: Sabres, Thunderstreaks and Thunderjets from the New World; Hunters, Meteors, D.H.110s, Gannets, Sea Hawks and Ouragans as partners from the Old World. Spectators will be able to compare the Fokker S.14 Mach Trainer with its Italian competitor the Fiat G-82. Every effort is being made to ensure a similarly representational variety of heavy aircraft at the ILSY-5. Probably American swept bombers as well as British delta bombers will be on show. They will be in the company of well-known light bombers such as the British Canberra and the American B-45 Tornado.

"The military part of the ILSY-5 programme will not merely consist of fly-pasts and aerobatics, there will be demonstrations of new methods of carrier landings, rocket-assisted take-offs, afterburners, flight refuelling, and life-saving by means of ejection seat and parachute. Well over a hundred entries have been received from parachutists. . . ."

In view of the fact that a civil-aircraft display will ensure that "the more peaceful aspects of aviation will not in any way be neglected," it is understandable that the organizers recognize that they will have "a considerable task in compressing all these interesting items into a programme lasting only a few hours."

First 1955 National Air Races

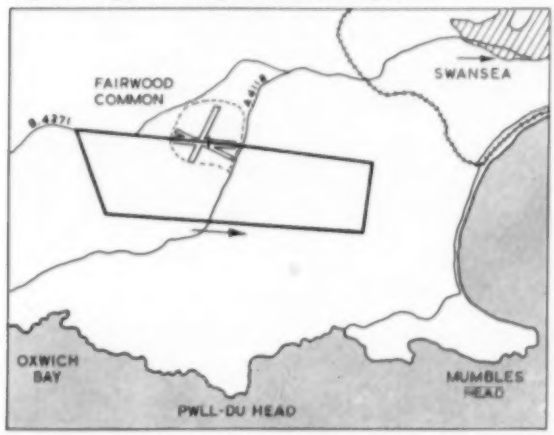
The Swansea Meeting: Free Public Admission

THE 1955 National Air Race programme opens at Fairwood Common Aerodrome, Swansea, tomorrow, April 30th, with a meeting comprising six class races with 25 entries in all. Second, third and fourth races for each of the six trophies will be flown at subsequent N.A.R. meetings, and, in addition, the King's Cup Race will form part of the final meeting at Coventry on August 20th. Results of the class races decide the placing for the British Air Racing Championship, in which the first 15 competitors will be eligible to compete for the King's Cup.

The Swansea meeting will be formally opened by Mr. John Profumo, M.P., at 2 p.m., and the race timetable is as follows:—

2.30 Air League Challenge Cup race (for Percival Proctors).
3.0 S.B.A.C. Challenge Cup race (aircraft, excepting Miles Geminis and Percival Proctors, with a maximum speed of more than 160 m.p.h.).
3.30 Norton-Griffiths Challenge Trophy race (D.H. Tiger Moths).
4.0 Goodyear Challenge Trophy race (Miles Geminis).
4.30 Grosvenor Challenge Cup race (Austers, and aircraft other than Tiger Moths, with a maximum speed of up to 130 m.p.h.).
5.0 Kemsley Challenge Trophy race (aircraft with maximum speeds of more than 130 m.p.h. and not eligible for the S.B.A.C., Goodyear or Air League classes).

Each race at Swansea will be flown over five laps of the course shown on the map below. The 8½-mile circuit comprises four track-legs of 278 deg T, 165 deg T, 095 deg T and 011 deg T respectively, and the total race distance is 42½ miles. Wind conditions permitting, the start will be from runway 29 (take-off being directly on course); the finishing line is at the intersection of runways 29 and 34. The short circuit will enable spectators to keep the competitors in sight most of the way round.



The course in relation to the surrounding countryside.

No.	Entrant	Pilot	Aircraft	Engine(s)	Reg.
S.B.A.C. Cup (aircraft exceeding 160 m.p.h.)					
92	G. C. Marler	Entrant	Falcon Six	Gipsy Six	G-ADTD
96	R. R. Paine	Entrant	Hawk Sp. Six	Gipsy Six 1F	G-ADGP
97	F. Dunkerley	—	Mew Gull	Gipsy Six 2	G-AEXF
98	F. Dunkerley	Entrant	Sparrowjet	2 Palas	G-ADNL
Goodyear Trophy (Miles Geminis)					
81	P. Blamire	Entrant	Gemini 1a	2 Cirrus Minor 2	G-ALZG
83	F. Dunkerley	Entrant	Gemini 1a	2 Cirrus Minor 2	G-AKKB
85	J. N. Somers	Entrant	Gemini 3	Gipsy Major 1c	G-AKDC
Air League Cup (Percival Proctors)					
67	E. Noel Husbands	Entrant	Proctor 1	Gipsy Queen 2	G-AIHG
69	T. G. Knox	Entrant	Proctor 3	Gipsy Queen 2	G-ALCK
Kemsley Trophy (aircraft exceeding 130 m.p.h. and not eligible for S.B.A.C. or Air League Cup)					
40	A. J. Spiller	Entrant	Messenger 2a	Cirrus Maj. 3	G-AKIN
41	A. J. Linnell	D. F. Ogilvy	Comper Swift	Pobjoy "R"	G-ABUS
43	J. R. Johnston	Entrant	Hawk Tr. 3	Gipsy Maj. 1	G-AJRT
45	C. G. Wheatley	Entrant	Globe Swift	Continental C-125	G-AHWH
47	J. N. Somers	Entrant	Chipmunk	Gipsy Maj. 10	G-AKDN
49	J. de Luigi	Entrant	Ambrosini S.1001	Alfa Rom. 110	I-RAMB
Norton-Griffiths Trophy (Tiger Moths)					
20	N. Jones	B. J. Snook	Tiger Moth	Gipsy Maj. 1	G-ANSH
21	N. Jones	B. Maile	Tiger Moth	Gipsy Maj. 1	G-ANSX
22	Hon. P. Vanneck	Entrant	Tiger Moth	Gipsy Maj. 1	G-ANOD
23	J. H. Denyer	Entrant	Tiger Moth	Gipsy Maj. 1	G-AIVW
24	J. M. Donald	Entrant	Tiger Moth	Gipsy Maj. 1	G-AMLF
Grosvenor Cup (aircraft up to 130 m.p.h., excluding Tiger Moths)					
2	Racorfilms	J. Crowdson	Agusta Bell 47G	Franklin 6VG-C32	G-ANZX
3	Miss F. M. Leaf	Entrant	Tipsy Tr. 1	Mikron 2	G-AFWT
5	C. Gregory	Entrant	Taylorcraft Plus D	Cirrus 1	G-AHGZ
7	R. Lamprell	—	G.A. Cygnet	Cirrus Major 2	G-AGAX
9	J. K. O'N. Edwards	D. Westoby	Aiglet J.5K	Cirrus Major 3	G-AMMS

Following the races an air display will be presented, including, it is hoped, a demonstration by an R.A.F. Hawker Hunter. Pleasure flights will be available before the meeting, from 10 a.m. to 2 p.m., and also after the meeting until dusk. Admission for the public is free; parking charges are 5s (cars) and 1s 6d (motor cycles); and special buses will run to the aerodrome from the central bus station in Singleton Street, Swansea.

ASLIB DISCUSSES TECHNICAL DATA

THE arrangement (including the classifying and cataloguing) of technical data is rapidly becoming the greatest problem of librarians and information officers. It is essential not only that facts should be filed but that they should be found again quickly, and it has become obvious that many present systems of classification and cataloguing are both inadequate and costly.

This year's fourth annual conference of the Aslib Aeronautical Group, held recently at the College of Aeronautics, Cranfield, was staged in collaboration with the Classification Research Group for the purpose of discussing this problem.

The papers presented* covered every aspect of the subject and were nearly, but not quite, as absorbing as the discussion which followed. As the meeting progressed, it became increasingly apparent that the ideal classification scheme does not yet exist. Personal preferences ran high and some energetic arguments ensued.

It was finally proposed, and unanimously adopted, that a professional team be set up for the purpose of further research and to formulate a scheme which could be universally worked but at the same time adapted, where necessary, to the special needs of users.

* J. E. L. Farradane (Tate and Lyle Research Laboratories), *The Psychology of Classification*; B. C. Vickery (Akers Research Laboratories), *Function of Classification in Information Retrieval*; E. G. Brisch (E. G. Brisch and Partners, Ltd.), *Subject Analysis in 81 Concepts*; C. W. Cleverdon (College of Aeronautics), *Some Aspects of Information Retrieval*; R. A. Fairthorne (R.A.E.), *Essentials for Document Retrieval*; Miss G. S. Rom (N.L.L., Amsterdam), *General Decimal Classification Systems for Aeronautical Use*; H. F. Vessey (R.A.E.), *Test of N.L.L. Card Catalogue of Aerodynamic Measurements*; R. G. Thorne (R.A.E.), *Efficiency and Cost of the Subject Catalogue*.

ON THE ROAD

SPECIFICATIONS, prices and performance data for some 80 British cars, together with information on accessories and equipment currently available are contained in the special British Cars and Accessories Number of *The Autocar*, on sale today, April 29th. Also published today, in *Motor Transport*, are detailed particulars of costs of operating goods vehicles, adjusted to cover new types from 5 cwt to 15 tons carrying capacity and to take latest prices and wages into account.

EAGERLY AWAITED: By the end of the year, Bomber Command should be piling up experience with the most compact and potent aircraft for its size yet built—the Avro Vulcan B.1. The Bristol-powered delta may be compared with the Valiant (p. 570), designed to less exacting requirements and already in service.

HERE AND THERE

Farnborough Jubilee Postponed

TO avoid a clash with next month's general election, the date of the Royal Aircraft Establishment's 50th anniversary celebrations has been changed to July 7th-9th. It is understood that Princess Margaret will visit the Establishment on the 7th.

The Double Film Première

THE second-night première of *The Dam Busters* film—on May 17th—will, after all, be honoured by Royal attendance: the Duke and Duchess of Gloucester are to be present. Princess Margaret is to attend on the first night.

Major French Air Rally

A LARGE-SCALE air rally is to take place at the time of the 21st Salon de l'Aeronautique. The principal organizer of the rally, M. Edmond Cornu, has announced that two groups of 50 aircraft will follow two routes across France and neighbouring countries, arriving together at Le Bourget on June 15th for the Private Aviation Day. The President of France has consented to be patron of the rally.

Strange Accident

A VARSITY which had taken off from R.A.F. Station Thorney Island last Monday night on an unauthorized flight disappeared in mysterious circumstances. It was said to have been piloted by an airman who had been engaged on aircraft maintenance at the station and who was believed to hold a civilian pilot's licence. As darkness was falling the aircraft was pursued towards London by the duty flight commander, F/L. J. Smiles, in another Varsity, in the hope that he would be able to guide the pilot in to a landing. Contact was lost, however, and eventually it was learned that the aircraft had crashed on a house in Northern France, causing a number of casualties.

Constellation Search

A SALVAGE vessel of the Royal Navy, H.M.S. *Barford*, is attempting to raise the wreckage of the Air India Constellation which was lost off the Great Natuna Islands on April 11th.

U.S.A.F. Accidents

AIRCRAFT accidents in the United States Air Force declined last year for the fourth year in succession. There were 20 crashes per 100,000 flying hours in non-combat operations, compared with 38 during the same number of hours in 1950. Fifty per cent of the total of 1,873 flying accidents in 1954 were due to human error.

The Late Maj. Halford

FOR the information of those who may wish to attend, and who may not have seen our announcement last week, we repeat here that the Memorial Service for the late Major F. B. Halford, C.B.E., F.R.Ae.S., M.S.A.E. (chairman and technical director of the de Havilland Engine Co., Ltd.) will be held at Christ Church, Down Street, London, W.1, next Thursday, May 5th, at 11.30 a.m.

For Safer Production

THE third Safety and Factory Efficiency Exhibition organized by the Birmingham and District Industrial Safety Group is to be held for one week from June 24th at Bingley Hall, Birmingham.

WORLD AIR POWER

TO a total of about 70, the world's air forces—their constitution, equipment and command—will be reviewed in detail in the special Military Aviation Number of *Flight* appearing on Friday, May 13th—a fortnight from now. Special data tables will also be given in reference to all types of military aircraft of any significance at present in service anywhere in the world. There is certain to be a heavy demand for this greatly enlarged issue, and we suggest that readers should place orders with their newsagents.

A.D.A.'s New President

AT the annual general meeting of the Aluminium Development Association held in London last week, Dr. Horace W. Clarke was elected president. Dr. Clarke, who is chairman and managing director of James Booth and Co., Ltd., was a pioneer in the development of Duralumin in this country, and of the early high-strength aluminium alloys used in Britain's first all-metal aircraft.

Education and Industry

THE principal speaker at the Public Schools Careers Masters' Convention, held recently in Liverpool, was Sir Ronald Nesbitt-Hawes, who is the English Electric Company's chief of educational administration. In his speech, Sir Ronald stressed the contribution made by the public schools to industry and commerce; he also mentioned that companies today were prepared to spend as much as £1,500 on the training of one young man.

FRIENDLY RIVALS: In a golf match between the Royal Air Force and the aircraft industry held recently at the Wentworth Club, the R.A.F. won by a substantial margin after two rounds of foursomes over 36 holes. Competitors seen in this photograph are, left to right, Mr. W. T. Gill, Air Chief Marshal Sir Francis Fogarty, Sir Roy Dobson and Air Marshal Sir Harold Lydford.

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THE SUPERCHARGED TURBOPROP

Dr. Hooker's S.A.E. Lecture on the Bristol B.E. 25, Successor to the Proteus

ALTHOUGH it has not yet run as a unit, the Bristol B.E. 25 has already been widely discussed, since it promises to offer a combination of performance and economy previously unmatched by any engine, and certainly not even approached by any engine of comparable size. The manufacturers, the engine division of the Bristol Aeroplane Co., Ltd., were, until last week, reluctant to discuss the engine in detail—justifiably so since, as we have remarked, the engine has not yet been run. Nevertheless, a comprehensive account of the engine's background and characteristics has now been given by the man best qualified to do so, Dr. S. G. Hooker, O.B.E., A.R.C.Sc., B.Sc., D.I.C., D.Phil., F.R.Ae.S., F.R.S.A., the engine division's chief engineer. His paper on the concept of the supercharged turboprop was read before the (American) Society of Automotive Engineers in New York on April 18th.

The concept of a supercharged turboprop, said Dr. Hooker, had been introduced by the Bristol B.E.25, and this design of engine was used to illustrate his paper. Going back to the conception of the B.E.25 some two and a half years ago, the underlying thoughts were:

(a) To produce a turboprop with a specific fuel consumption equal to that of the best compound piston engine. This implied a pressure ratio greater than 10:1, and hence necessitated the "two-spool" arrangement of compressors.

(b) To produce a turboprop having a cruising power of the order of 3,500 h.p. at 30,000ft, with the lowest possible specific weight. Such an engine would give more than 8,000 h.p. at full throttle at sea-level and it was desired to restrict this power to between 4,000 and 5,000 h.p. in order to reduce the weight of the reduction gear and airscrew and thus achieve an appreciable improvement in the specific weight under cruising conditions.

(c) To produce a turboprop the take-off power of which was independent of the altitude and air temperature of every aerodrome in the world. Naturally aspirated turbine engines (i.e., those now in use) suffered badly at the higher and hotter airfields, although the adverse effect of high temperature could be partially mitigated by water/methanol injection.

(d) To exploit to the full the known ability of the gas turbine to produce (relative to piston engines) large power for a small bulk and weight.

It would, said the lecturer, be practically impossible to produce a reciprocating aero engine for transport use with a conservative cruising power of 3,500 h.p. at 30,000ft. The desirable properties outlined in (a), (b) and (c) above were all enjoyed by the supercharged piston engine, and this was the fundamental reason why such engines had almost completely displaced the naturally aspirated engines of the early days of flying.

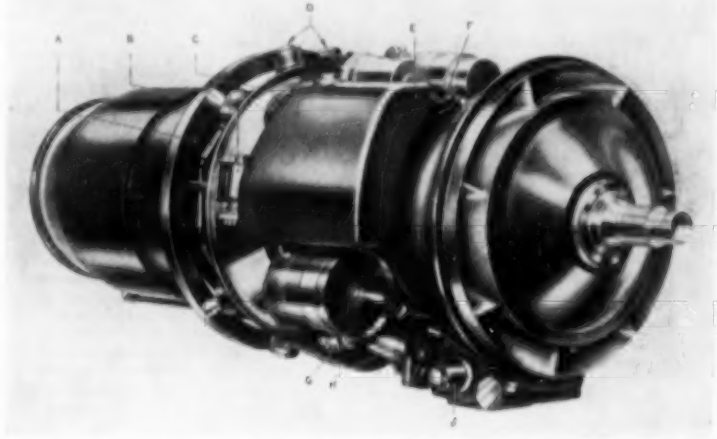
A diagrammatic section of the B.E.25 showed a single high-pressure turbine stage driving the high-pressure compressor and a three-stage l-p turbine driving the l-p compressor and airscrew reduction gear. Basic engine control was effected by two levers, one of which was a fuel throttle governing the power and speed of the high-pressure system and the other was connected to a constant-speed unit controlling the pitch of the airscrew, and hence the speed of the low-pressure (or supercharging) unit. The apportioning of compression between the low- and high-pressure systems had to be carefully chosen so that, whatever the speed-ratio between the two, neither ran into a surging condition.

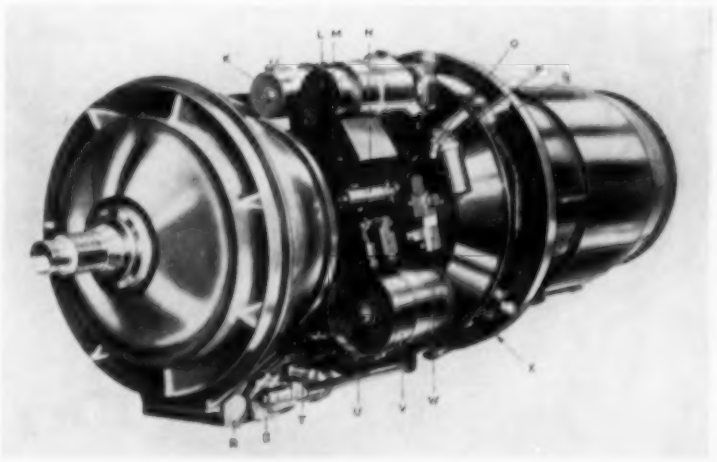
The engine incorporated a compound epicyclic reduction gear in which the torque transmitted was measured on the final floating annulus gear by oil pressure on a torque-reacting piston. Torque limitation was provided by balancing the torquemeter pressure against fuel pressure at the engine burners.

It was a characteristic of turboprops that their specific fuel consumption decreased with increase in turbine-inlet temperature. Experience had shown that the reliability and longevity of the combustion system, turbine blades and other "hot" components fell rapidly as their operating temperature was increased. It was therefore desirable to strike a compromise with temperatures on the low side, despite the disadvantages in performance, in order to achieve a long life with a high order of reliability. Little advantage was to be obtained by reducing the inlet temperature much below 1,000 deg K or 1,300 deg F, and this was therefore chosen as the cruising temperature for the B.E.25. Fig. 1 showed the specific consumption obtained at 25,000ft and 300 m.p.h. in engines with various compression ratios.

It should be noted that, with this peak temperature (turbine-inlet temperature), and with a cruising pressure ratio of 10:1, an s.f.c. of 0.37 lb/hr/e.h.p. was indicated. Higher compression ratios would be an advantage, but the specifics of the best reciprocating engine could be beaten at the figure quoted, which was well within experience of two-spool compressors.

Turboprops had so far lagged behind the turbojet in aerodynamic performance, owing to the great advantage of jet propulsion for military purposes and to the relative simplicity of such engines. Now that this first phase was over, turboprops were being designed which were thermodynamically equal, and greatly superior in propulsive efficiency, to turbojets at their appropriate flight conditions. In fact, the turboprop responded better to improvement in the thermodynamic cycle than did the turbojet, since any improvement in compressor or turbine performance of the latter increased the velocity of the jet and thus decreased the overall propulsive efficiency. On the other hand, corresponding improvements in the turboprop cycle yielded an increase





Photographs of the mock-up B.E.25. Made almost entirely of steel, the new engine will weigh scarcely more than a Proteus. Provisional B.E.25 data were published in our issue of January 28th last.

A, fuel manifold; B, engine de-icing valve; C, bulkhead inner section; D, air supply to aircraft for pressurizing and wing de-icing (two ducts at top, two at bottom); E, oil tank; F, airscrew brake link; G, airscrew-turbine overspeed governor; H, airscrew feathering unit; J, airscrew synchronizer generator; K, electric starter; L, 50 kVA alternator; M, "Ultra" control unit; N, starting pump; O, throttle and air/fuel-ratio control; P, fuel filter; Q, four dynamic suspension units; R, scavenge filter; S, oil pump; T, oil-pressure transmitter; U, fuel pump; V, 10in oil-cooler (port and starboard sides); W, barometric-pressure control, torque limiter and shut-off cock; X, mounting ring (powerplant supply).

D

THE SUPERCHARGED TURBOPROP . . .

in power which could readily be transferred by the airscrew into useful thrust without loss in propulsive efficiency.

The curves of Fig. 1 postulated polytropic efficiencies of 90 per cent for both the turbine and the compressor. This was a high figure, but one which had been achieved during component testing, as Dr. Hooker indicated with diagrams. However, slightly lower figures (varying with Reynolds number in the case of the compressor) had actually been taken in the design of the B.E.25. A particular feature of the two-spool compressor was its ability to maintain a high efficiency at both high and low pressure-ratios, a characteristic which led to great flexibility and stability in engine operation.

It was worth emphasizing that, the higher the overall efficiency of any engine, the wider the range of operating conditions over which it could be used with advantage. Thus, an efficient turboprop was less sensitive than the turbojet to speed and altitude.

In comparing the performance of various types of engines, one of the most convenient quantities to examine was the engine mass flow at maximum sea-level static conditions. This quantity was akin to the swept volume of a piston engine, and could be used as a rough indication of power output. On the test-bed a turbojet gave roughly 60 lb thrust for every lb/sec of airflow, while the corresponding figure for a turboprop was roughly 100 h.p. for every lb/sec. Turbojets were now flying with mass flows approaching [and exceeding.—Ed.] 200 lb/sec, whereas modern turboprops generally did not exceed one-quarter of this value. It was, therefore, not surprising that the turbojet had shown up to advantage at high altitudes; despite the better propulsive efficiency of the airscrew, the power of the jet greatly exceeded that of the airscrew-driving unit at altitude, owing to the far greater capacity of the turbojet to handle air.

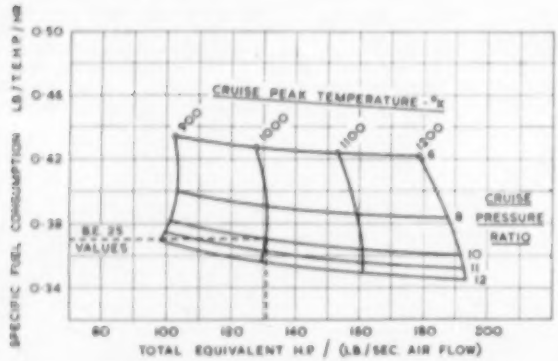
Attempts to correct this deficiency on the part of the turboprop led to an engine with an exceptionally high sea-level power, and this, in turn, posed a great problem of transmitting the power through a reduction gear and to an airscrew capable of absorbing it. Furthermore, turboprop transport aircraft achieved their best overall cruising performance when flying at 25,000 to 35,000ft, at which condition the power output would be approximately half of the sea-level maximum. It was desirable, therefore, in the interests of achieving minimum powerplant weight, to restrict the take-off power to roughly the altitude-cruise value.

In order to avoid detonation at the weak mixtures used for cruising, it was necessary to reduce the cruising power of a supercharged piston engine to about 60 per cent of its take-off power. No such limitation was imposed on the turboprop and, subject to the remarks made earlier on the effect of turbine-inlet temperature upon reliability and durability, such an engine could be operated at constant power. A typical series of power curves for the B.E.25 was shown in Fig 2. In this diagram the 10,500 low-pressure r.p.m. curve corresponded to maximum conditions and would in fact be used only for take-off. The continuous cruise rating was 8,860 l-p r.p.m. which yielded 3,380 h.p. in the airscrew up to 17,500ft, the additional power (up to 4,150 e.h.p.) being due to residual jet thrust. Thus, at 30,000ft and 220 m.p.h. equivalent airspeed (corresponding to 363 m.p.h. true), the engine gave 3,500 e.h.p. with an s.f.c. of 0.40 lb/hr/e.h.p. The turbine-inlet temperature was held constant at 1,340 deg F at full throttle above 17,500ft. Below this altitude the cruising power was restricted by the torque-limiter, and at lower altitudes the turbine-inlet temperature fell to lower values.

Two other important points arising from these curves were first, that the B.E.25 could be throttled to less than half power at 7,900 l-p r.p.m. at 30,000ft with an s.f.c. of 0.45 lb/hr/e.h.p. and second, that at 25,000ft and 8,400 l-p r.p.m., 2,700 h.p. could be obtained at a specific of 0.44 lb/hr/e.h.p. although at this speed the engine would be at full throttle from sea-level upwards. The curves of this diagram were illustrative only of engine performance, which varied with T.A.S. owing to the change in ram effect and available jet thrust. At speeds higher than 220 m.p.h. E.A.S. the specific fuel consumption would be lower, owing to the greater value of the residual jet thrust at higher airspeeds.

Turning to the conditions at take-off, Fig 3 compared the supercharged engine and a normally aspirated turboprop—in this case the Bristol Proteus 755. The curves showed the equivalent h.p. for take-off as a function of altitude for various temperatures (e.h.p. being defined as airscrew h.p. plus jet thrust÷2.6). The loss of power suffered by the normal turboprop at high and hot airfields was obvious; at Mexico City, for example, the power of the Proteus was reduced from 4,150 e.h.p. to 2,800 e.h.p.—a loss of over 30 per cent—and in this respect it was no worse than any other turboprop now flying. Even with water/methanol injection sufficient to reduce the intake air temperature from 30 to 15 deg C, the power could not be raised above 3,150 e.h.p. since nothing could compensate for the altitude effect. On the other hand, the supercharged turboprop suffered only a slight loss of power with temperature and altitude as a result of the reduced jet thrust; even at La Paz the loss was only 16 per cent.

One of the great mechanical problems in turboprop development had always been reduction gear. In the case of the B.E.25 (and the Proteus), the overall ratio was 11.1:1, achieved in two



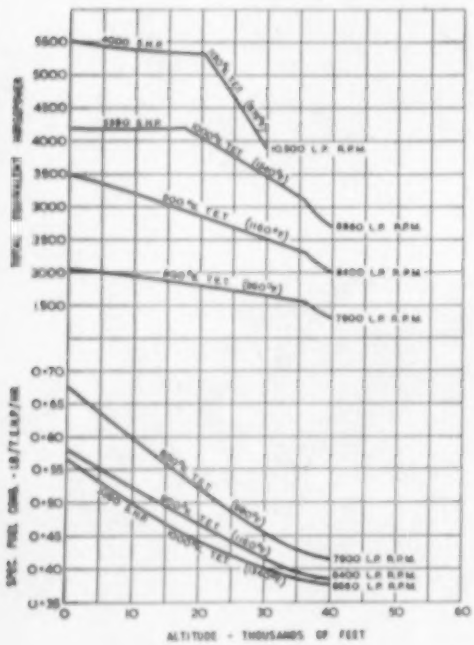
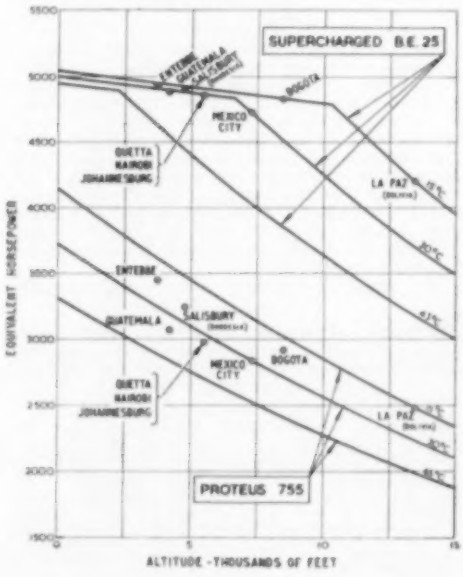


Fig. 1 (Above) Generalized turboprop performance showing the distribution of power between airscrew and jet to give maximum propulsive efficiency at I.S.A. 25,000ft and 300 kt. Efficiencies assumed: compressor and turbine 0.90 polytropic; air intake 0.90; reduction gear 0.98, and airscrew 0.85. Duct losses are taken to be five per cent.

Fig. 2 (Left) B.E.25 power and s.f.c. at 220 m.p.h. E.A.S.; assumptions—no intake loss or accessory power take-off.

Fig. 3 (Right) Effect of altitude and temperature on take-off power for the B.E.25 and Proteus 755.



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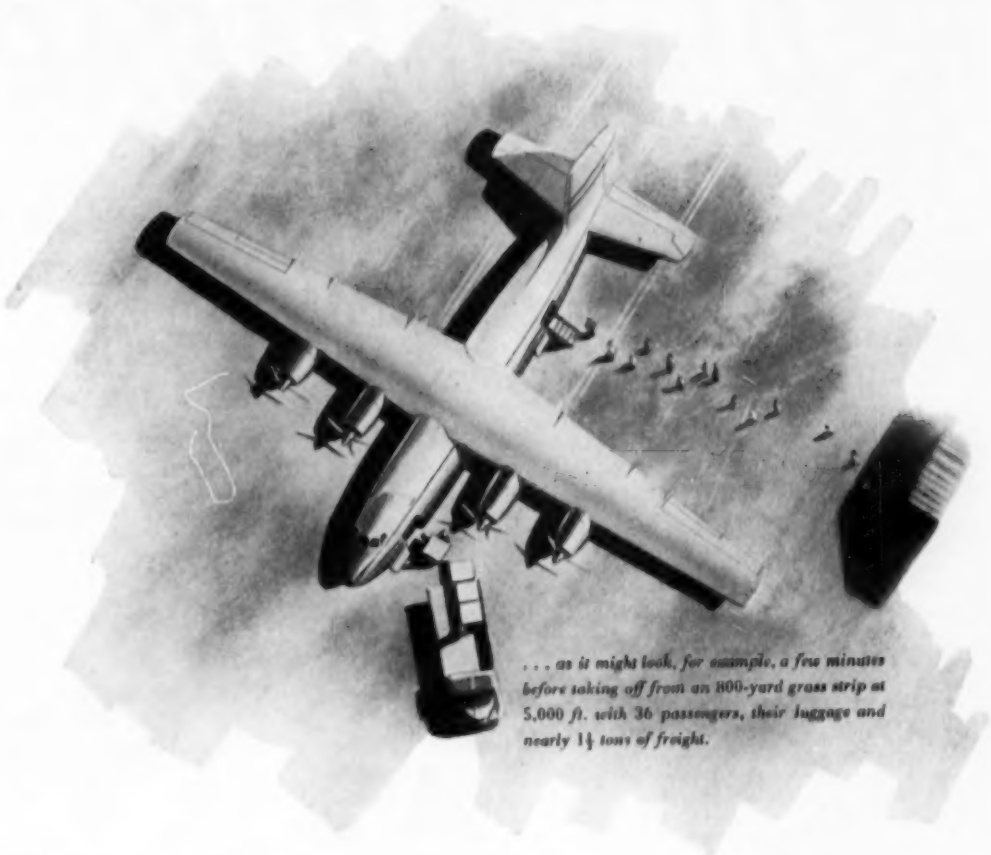

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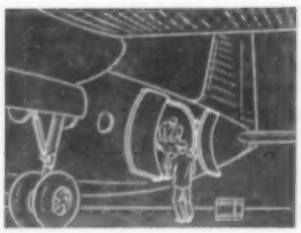

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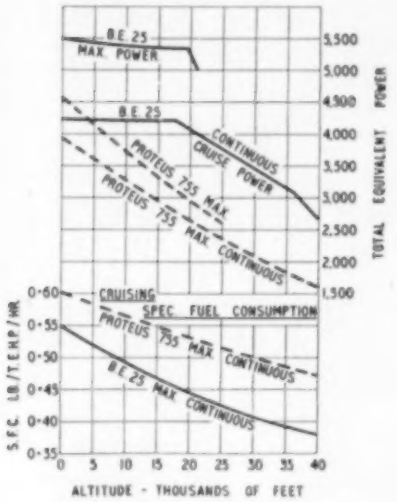

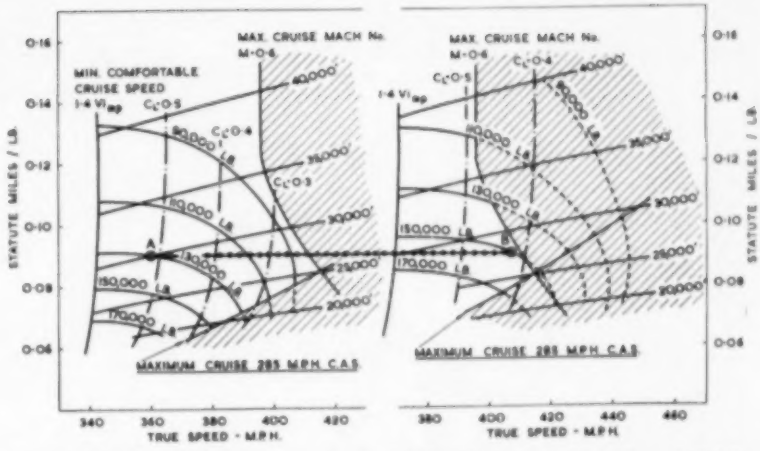

Fig. 4 (Left) Power and s.f.c. curves for the B.E.25 and Proteus 755 at 220 m.p.h. E.A.S.

Fig. 5 (Above) Performance of a Britannia-size transport with Proteus (left) and B.E.25s.

THE SUPERCHARGED TURBOPROP . . .

stages of epicyclic gearing. The actual gears used in the B.E.25 were to be double-helical units virtually identical with those used in the Proteus 755 at a rating of 3,650 shaft horsepower. It was proposed, however, to rate the gear for the new engine at 4,000 s.h.p. and an illustration showed the actual gear-box under endurance test at 4,250 s.h.p. [reproduced last week.—Ed.].

In this particular rig, two Proteus were coupled together and their joint output passed through the test reduction gear. In this way it would be possible to test the gear up to 7,000 h.p. if necessary, but testing was currently concentrated in the 4,000 to 4,500 h.p. range. The fact that an existing gear with many thousands of hours of experience behind it was available for the B.E.25 was expected to prove an immense advantage in the development of the new engine.

The B.E.25 low-pressure compressor was aerodynamically identical with one which had already been rig-tested to a total of some 500 hr. When the first B.E.25 is run as a unit in the autumn of this year, the Bristol Company expect the l-p compressor to have accumulated some 2,000 hr running and this, again, would be very valuable. The blading and casings of both compressors of the B.E.25 were to be entirely of steel. Experience with the Proteus had shown that steel blades were capable of "swallowing" quite large pieces of ice, and no catastrophic failure resulted even from the passage of a nut or bolt. Quite recently, during Britannia flight trials, one engine suddenly lost 300 h.p., and on examination it was found that a steel pin had passed through the compressor. Dr. Hooker showed a photograph of this compressor and the minor damage to the blading was obvious.

The combustion chamber of the B.E.25 would be a tubo-annular, or cannular, design and the chambers themselves would be based on the unit employed in the Proteus. Chambers of this design had already completed 500 hr endurance tests without servicing of any kind and, in fact, had been found fit for further service after periods in excess of this value.

The mechanical design of the turbine would be based on that of the units employed in the Proteus, with shrouded blades on the first three stages and open blades on the last wheel. Dr. Hooker showed a photograph of Proteus turbine wheels after 1,230 hr of endurance running without attention and a cruising temperature some 75 deg C hotter than would be employed on the B.E.25.

It was proposed to supply the B.E.25 as a complete powerplant, equipped as an engine-change unit with cowling. In the first place the engine would be applied to the Bristol Britannia and, since the powerplant requirements for this aircraft were entirely known, it had been possible to design all the essential features into the engine from the beginning. The airscrew would be the existing de Havilland four-blade 16ft-diameter unit as used on the Proteus 755 in the present aircraft. This airscrew was at the moment undergoing endurance testing on the same rig as that used to test the reduction gear.

At 10,500 l-p r.p.m., the airscrew r.p.m. were 945, at which some static thrust was sacrificed. At 120 knots the airscrew thrust was sensibly independent of r.p.m. and, in addition, the engine gave 2,400 lb jet thrust under torque-limited take-off conditions. Cruising at altitude, the airscrew r.p.m. would be under 800 (this figure corresponds to 8,860 l-p r.p.m.), and the rotational tip speed rather less than 700ft/sec, which should make for a very low noise level. A free-air efficiency of 86 per cent was computed at 400 m.p.h. T.A.S.

In addition to providing shaft power, the B.E.25 in the Britannia would also supply the following services:

(1) 47 kVA generator, driven by the h-p compressor, and thus running almost at constant speed. It would not be necessary to employ super-fine airscrew pitch in order to maintain electric generation while taxying.
(2) Cabin pressure air to maintain s-l pressure to above 35,000ft.
(3) Air for wing ice-protection at 180 deg C.

(Items 2 and 3, being taken direct from the l-p compressor, had no effect upon the temperature operation of the engine but merely reduced the airscrew power. During torque-limited flight, such as a steady climb, bleeding l-p air would have no effect on power but had to be paid for by increased fuel consumption.)

(4) An air-bleed to operate an injector for cooling the rectifiers.
(5) Airscrew thrust-reversal would be used for braking.

It would be seen from photographs of the mock-up, that all the powerplant items were grouped around the l-p compressor, ahead of the built-in firewall. In general, the electrics were mounted on top of the engine, the fuel-control system on the side and the oil system underneath. Great attention had been paid to fire protection and it should be impossible for fuel to come into contact with metal hotter than 150 deg C. The engine was mounted from four dynamic suspension units focussed on the centre of gravity. The weight of the B.E.25 powerplant was summarized as follows: dry engine complete with oil tank, coolers, and Dynafocal units, 3,200 lb; electrical systems, 248 lb; cowlings and mountings, 422 lb; cooling ducting, fire extinguishing and sundries, 220 lb; and airscrew and spinner, 870 lb, making a total of 4,960 lb. These weights did not involve the use of any titanium, which would be introduced later to effect important weight-saving.

It could be seen that the B.E.25 gave 3,500 total e.h.p. for continuous cruising at 30,000ft as against 2,000 for the Proteus 755. On the Britannia the effect of an increase of 75 per cent in the cruise power per engine would be very great, and could produce an aircraft speed in excess of the limiting Mach number for which the wing had been designed ($M = 0.63$). Consequently, the full cruise power of the new engine would not be used with the Britannia and, almost for the first time in history, there would be a transport aircraft with excess power available, and the surplus would be of great advantage in the *en route* engine-out case.

The overall effect on the performance of a Britannia-like aircraft was shown by the lecturer (Fig. 5). Taking point A on the left-hand series of curves for an aircraft weighing 130,000 lb, the statute miles per lb of fuel could be read as 0.09. Moving to the right-hand curves and considering point B, which also gave 0.09 st.m./lb, it could be seen that the speed of the aircraft had increased from 360 to 407 m.p.h., but under these conditions the all-up weight could be increased to 150,000 lb, i.e. 20,000 lb more payload could be carried the same distance, 47 m.p.h. faster. Even in this case the power required was only 25 per cent greater than that given by the Proteus 755.

Alternatively, the all-up weight could be maintained at 130,000 lb, in which case the aircraft would cover 0.11 st.m./lb at 400 m.p.h. at about 33,000ft, i.e. an increase in range of 20 per cent at the same all-up weight with 40 m.p.h. increase in speed.

If the Mach limitation on the wing could be lifted, then much greater cruising speeds—of the order of 460 to 470 m.p.h.—could be obtained. The situation was, therefore, that the full potential of the new engine could be exploited only when a new airframe became available.

An F-86D attacks.

AUTOMATIC INTERCEPTION

All-weather Single-seaters Defending the United Kingdom

FOR forty years, one of the most obviously important functions of military aircraft has been the interception and destruction of raiding bombers. The requirements of this task have been met by widely differing aircraft, some being relatively light and simple day "intercepters" and others being massive two-seat machines packed with electronic equipment for fighting at night, or in weather conditions too poor for the operation of single-seaters.

Today it is immeasurably more important than ever before to ensure that no bomber can launch a weapon at any of our cities or other major targets. It is not the purpose of this account to describe how this can best be done—if, indeed, it can be done—and so draw into the discussion the possible roles of guns, ground-to-air missiles (guided and otherwise) and fighters (multi-seat, single-seat or pilotless). We are here concerned solely with one type of intercepter which, although new to this country, is at this moment assisting in our defence.

Originally, all the night and all-weather jet fighter squadrons of the U.S.A.F. and U.S. Navy were equipped with large two-seat aircraft, such as the Lockheed F-94B and Douglas F3D. In these aircraft, the target was located by the A.I. radar under the control of the navigator, the pilot flying the aircraft according to the navigator's instructions. Such a system suffers from several fundamental disadvantages; there is a double possibility of human error; there is a time lag between the receipt of target information and its application to the flight-path of the fighter; the interception has to follow a "curve of pursuit" and the A.I. radar can be put off the scent by "chaff" dropped by the bomber.

What America urgently needed was an interception system which, in the words of Gen. B. W. Chidlaw, commander of the U.S.A.F. Continental Air Defense Command, could "come on target instantly, accurately and so destructively, day or night, in all weather, that no condition of utmost favour to the attacker was able to put him out of our reach to bring him down."

To meet this great need, the E-4 fire-control system was developed for the U.S.A.F. during the late 1940s, the prime contractor being the Hughes Aircraft company, of California. Details of this system are still secret, but it can be said to comprise an advanced form of radar capable of searching for, locating and locking-on to a target, together with a continuously computing sight mechanism and fire-control, the whole being coupled to the flying controls of the fighter by means of an advanced automatic pilot. Such a system can carry out a complete interception without human aid, once the aircraft has been directed into the neighbourhood of its quarry and pointed roughly in the correct direction. As a result, it has been found entirely practicable to *dispense with the navigator* and develop single-seat all-weather machines, of smaller size and higher performance.

The first single-seat all-weather intercepter to enter service was the North American F-86D Sabre, a direct development from the renowned day fighter. Compared with the latter, the "D-type" Sabre (colloquially, the Dog) has obvious superficial changes, including the installation of the scanning equipment in the nose beneath a dielectric fairing, a revision of the horizontal tail surfaces (present Dogs have a large single slab-type tailplane without dihedral) and the installation of a clamshell-type cockpit canopy. Owing to the increase in all-up weight, and to the fact that any intercepter has to have a rapid climb and good performance, the engine was fitted with an afterburner; present "Ds" have the J47-GE-33, giving 5,800 lb thrust, or nearly 8,000 lb reheated.

The pilot of an intercepter of this nature has a full-time job, and his task must be eased as far as possible by mechanical aids. In the F-86D, engine control is made entirely automatic from the time the pilot sets the installation up for starting. This relieves him of all worry over such factors as tail-pipe temperature and compressor stall, irrespective of the casualness of his treatment of the engine (this, and many other aspects of the F-86D, received prominence in a description of Sabre variants in our issue of January 15th, 1954). Another noteworthy feature of the D-type Sabre is that it mounts no guns. Its offensive armament consists solely of 24 "Mighty Mouse" folding-fin aircraft rockets (F.F.A.R.s).

The F-86D entered service with the U.S.A.F. in the summer of 1952. At first it was found only in Training Command, but it later assumed its rightful place in the Air Defense Command, alongside its two-seat predecessors. From the outset it was known as a "hot ship" in the best sense of the term, and it is still the fastest all-weather intercepter in service with any Air Force. Today it is in service in larger numbers than any other all-weather defensive aircraft—in the "West," at least—and units equipped with it are now permanently based here and in W. Germany. The principal task of the British-based Ds is "To conduct air defense of the United Kingdom under the operational control of the Royal Air Force Fighter Command." For general administrative purposes, however, and during day-to-day flying, the squadrons come directly under H.Q., U.S. Third Air Force.

We were recently privileged to visit R.A.F. Station Manston, the home of two squadrons of D-type Sabres (pictures were published in our issue of April 15th).

All the F-86Ds in Britain are assigned to a wing which was originally activated on October 10th, 1950, as the 123rd Fighter/Bomber Wing. It was, like many other wings at this time, formed from squadrons of the Air National Guard (corresponding to our R.Aux.A.F.), one squadron being drawn from North Carolina, another from West Virginia and the third from Kentucky. With supporting formations drawn predominantly from N.C. and Ky., and with a small base complement squadron of the regular U.S.A.F., it became operational at Godman A.F.B., Fort Knox, Ky., equipped with North American F-51D Mustangs.

During the spring and summer of 1951, the 123rd took part in various manœuvres in the U.S.A., and the Wing was selected, with other units of the Tactical Air Command, to stage a demonstration of fire power to assist ground forces to obtain the best close support from the air. In September of that year the Wing was ordered to the United Kingdom (to Manston, Kent); an advance party arrived on November 11th and the main force followed 29 days later. It was the first U.S.A.F. unit to be permanently based at Manston since World War 2.

When the 123rd left the U.S.A. it left its Mustangs behind, and the three squadrons of the Wing (Nos. 156, 165 and 167) took over the Republic F-84Es left behind by the departing S.A.C. unit which had previously occupied Manston. During 1952 the Wing became fully jet-converted and "worked up" on the Thunderjets. In September 1953, the unit again had a change of aircraft; the ageing F-84s were traded for North American F-86F Sabres. By March 1954, the Wing was combat-ready, and it was re-numbered 406 Fighter/Intercepter Wing in accordance with the established usage of its new aircraft.

Since the end of fighting in Korea, personnel drawn from the Air National Guard have gradually been returned to civil life. At the same time, former A.N.G. squadrons have also been returned to State control; in the case of the 406th Wing, this was largely a paper transaction, as very few A.N.G. men were left. The present composition of the 406th Wing is now as follows: headquarters, 406 Fighter/Intercepter Wing (at Manston), Col. C. J. Herlick, commanding officer, and Col. W. S. Harrell, group commander; 87 Fighter/Intercepter Squadron (Bentwaters, Suffolk), Lt-Col. Michael J. Quirk; 512 Fighter (Day) Squadron (Soesterberg, Holland), Lt-Col. Frank M.

No Future

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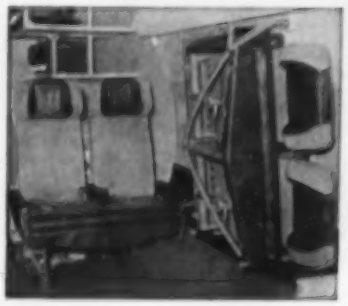

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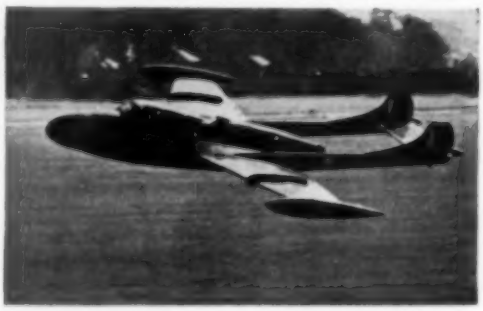

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AUTOMATIC INTERCEPTION . . .

Haynie; 513 Fighter/Intercepter Squadron (Manston), Maj. Jack B. Owens, 514 Fighter/Intercepter Squadron (Manston), Lt-Col. George O. Hubler.

With the exception of 512, which still retains the F-86F, all these Squadrons are fully equipped with the F-86D Sabre. Squadrons 512, 513 and 514 are the original 123 Wing units re-numbered; the 87th is an additional unit which only arrived in England last December 21st from Sioux City, Iowa, where it had been stationed as a unit of the Air Defense Command. The 87th has been flying the D-type Sabre for almost two years, and it has an outstanding safety and operational record.

The "original" squadrons now equipped with the F-86D (513 and 514) began to convert as recently as last December, and are not yet combat-ready. The majority of their pilots are relatively young and inexperienced, although senior pilots and flight commanders all have two or three years' all-weather jet experience.

Conversion to the Dog is enormously facilitated by the use of an electronic (Erco-Westinghouse) flight-simulator, of the same general type as is now employed for all complex types of aircraft. Initially, the pupil spends a total of 10 hr in the simulator, during which time he becomes thoroughly familiar with all the procedures of flying the aircraft, carrying out interceptions and—most vital of all, at this stage—dealing with emergencies. The extreme automaticity of the aircraft requires exhaustive instruction and practice in coping with all kinds of unusual failures. The simulator probably saves many $\frac{1}{2}$m Dogs from destruction.

Twenty-eight hours of ground school follow next. Instruction is given with the aid of numerous very impressive mobile rigs showing complete "systems" of the aircraft, and many of the instructors are technicians sent to England by North American Aviation, American G.E.C., Hughes, Lear and other firms.

The pupil then carries out 10 "chase rides" in the real aircraft, accompanied by an instructor who loosely formates and watches his progress. These flights suffice to make the pupil familiar with the aircraft, both visually and on instruments. The next 30 hr flying is devoted to day radar work, in which all types of interception are simulated. A night check-out follows, after which the pupil completes 10 hr night radar flying. During this advanced conversion, actual rockets are fired. All radar and rocketry missions are observed by instructors in chase aircraft or in ground-control stations; further experience is built up by practising interceptions in the simulator. At the conclusion of all courses, the pilot is classed as combat-capable.

Typical Practice Tactics

Starting is electric. Once the power lever has been positioned for starting and the electronic engine control switched on, the behaviour of the engine is governed automatically. The power lever can, in fact, be pushed right forward into the afterburner position during the starting cycle, and the engine then accelerates as rapidly as it can without approaching the compressor surge line or exceeding the limiting turbine-temperature.

The afterburner is normally brought in for take-off, unless the mission is likely to call for maximum endurance. The climb away is not spectacular unless the afterburner is used, in which case the whole aircraft seems to become re-vitalized. General handling of the present Ds is excellent; the earlier machines (up to F-86D-25) tended to be very sensitive in pitch control, but the F-86D-45 and -50 is rated very highly, the slab tailplane being powerful and smooth in all flight conditions. The D is, at around 20,000 lb, over 1$\frac{1}{2}$ tons heavier than the F-type day fighter; it is not normally flown in formation or subjected to violent manœuvre, but its slatted wing enables it to out-turn day Sabres at lower speeds. The F-86F can, however, "pull more g" as a result of its "slick"-type 6-3 wing.

When the E-4 fire-control system picks up a target, it "locks on" and, by means of the Lear autopilot, can steer the aircraft so as to effect a successful interception. The actual flight-path is so controlled as to aim the fighter at its target when the latter crosses the fighter's bows. This type of interception, called "collision-course" interception, has singular advantages, which become apparent when one considers what is going on.

The fighter is tracking a bomber according to the "return" received by the fighter's radar. The bomber dispenses a stream of reflecting material, termed "chaff" or "window," which clutters up the fighter's radar with echoes and prevents the bomber from showing up as a clear "blip." If the fighter approaches the bomber from the rear, it has to fly through the chaff and the latter effectively masks the bomber from the fighter's radar until it is far too late to make a proper firing pass. Meanwhile, the fighter may be exposed to defensive fire from the bomber.

A collision-course attack starts when the fighter is still as much as 30 miles away, closing rapidly upon the bomber from abeam. In this position, the radar return from the bomber is stronger than that from any dispensed chaff, and the target can thus be seen distinctly by the fighter. If the fighter is fitted with a really effective automatic control system, it can home on to the bomber from the side, attack and then break away.

Clearly, the technique requires absolutely reliable automatic control, in order that the interception shall be accurate and yet safe for the attacking fighter. The break-away is also automatic, and it makes the fighter flash over or under the bomber's track in a tight dive or pull-up. Control is then returned to the pilot.

The 24 "Mighty Mouse" F.F.A.Rs. are carried in a tray mounted under the belly, which normally lies flush with the exterior skin. The F.F.A.R. has a calibre of 2$\frac{1}{4}$in, and a striking power roughly equivalent to that of a 3.7in shell. It is not guided in flight, and has no "intelligence," i.e. it does not home on to a target. In flight it is spin-stabilized, and has four narrow-chord fins which are folded while the missile is in its launching tube but flip open during the initial stages of flight. The acceleration at launching is very high, and 2,000 m.p.h. is rapidly reached. The warhead is normally set to explode at about 1,000ft range, or upon impact.

During the initial stages of the interception the pilot uses his autopilot to assist him in flying the aircraft correctly. Control is then turned over to the radar fire-control which, depending on whether or not it is coupled to the autopilot, either produces a steering dot which the pilot keeps visually centred on a screen or else carries out the interception automatically, as described. At the optimum range the computing sight extends the rocket tray, fires some or all of the missiles, retracts the tray and starts the break-away.

Accessories after the Fact

The sudden projection of the rocket package into the air-stream naturally causes a pitch change, but this is automatically countered by a pitch-control unit "tied" to the slab tailplane; the resulting movement in the pitching plane is scarcely noticeable. In any case, the firing control is such that the tray is extended for less than five-eighths of a second. When under fully automatic control, the E-4 fire control is not supposed to fire at all unless certain of hitting the target. If the attack is taking place at medium altitude—say 30,000ft—control is so good that the pilot may elect to fire only a proportion of his rockets, in the sure knowledge that this will be sufficient. At high altitudes, however, all 24 will be fired in one salvo; after all, it is highly unlikely that it will be possible to make more than one attack at any given target, and destruction of a raiding bomber has to be ensured.

In the event of failure of the fire control, it is still possible to attack with the aircraft under manual control. In this case, however, collision-course interception is obviously impossible, and the best thing that the pilot can do—having no computing sight—is to get behind his target, fire some Mighty Mice, see where they go, and try again.

Practice interceptions are regularly carried out by the pilots of 406 Wing, and proficiency is rapidly acquired. Sheer skill is less important than following the rules and flying correctly; if this is done, the system can practically guarantee a hit. When the F-86D first entered service it was so complex and new that serviceability was poor, and true automatic interceptions were the exception rather than the rule. Today the reverse is the case. Acual firing trials are carried out against 6ft by 30ft towed banners carrying tinfoil strips or shaped radar reflectors.

Once having made its interception, the Dog can let down very fast by opening its speed brakes. If the nose is allowed to drop with the aircraft clean, the D goes "through the barrier" more readily than do day Sabres, on account of its greater weight. Navigation can be assisted by the radar carried, which (like the MG-4, described in our issue of March 25th) can paint pictures of the ground. The D is also fitted with I.L.S. equipment, which can be coupled to the autopilot, airliner-fashion, so permitting the pilot to let-down through the worst weather.

The F-86D autopilot is the Lear F-5; this, and its derivative the L-10, formed the subject of a description on p. 220 of our February 18th, 1955, issue. A Sperry Zero Reader is also employed during bad-weather approaches down an I.L.S. beam. Naturally, as the pilot closes on the I.L.S. transmitters he receives a progressively rougher ride, until he can see the runway and land visually.

Approach and landing are similar to that of any other slatted Sabre, although the Dog's great weight has required the insertion of extra discs in the wheel brakes. A ribbon drag chute, of 20ft diameter, is also carried. This is housed in a small box below the trailing edge of the rudder, and it is streamed whenever the occasion demands—possible reasons being brake failure, a wet runway or diversion to a base with insufficient field-length. Use of the drag chute reduces the landing roll to under 2,500ft, even on a wet runway. It was illustrated in our issue of April 8th.

In practice the employment of an intercepter is related to the importance of the mission. Unless otherwise ordered all-weather F-86D pilots fly to established minimum weather conditions. These intercepter pilots are all of above-average proficiency in instrument flying, and it is theoretically possible to operate in absolutely zero-zero weather, if the occasion demands. W. T. G.

MEETING OF THE AIRWAYS

WITH a characteristically bold brush, Gordon Horner sketches here the path followed by passengers using London Airport's new terminal building—now the junction for ten international airlines serving scores of domestic and Continental destinations. London's crowded temporary terminal, which still handles most long-distance traffic, is no place for the leisured observer seeking to absorb the atmosphere of a great airport. From the roof gardens and terraces in the new central area, however, visitors will enjoy spacious views of the marshalling apron and its teeming, multi-coloured traffic.

AFTER CHECKING IN THEY TAKE THE CENTRAL ESCALATOR TO THE MAIN CONCOURSE. MEANWHILE THE LUGGAGE GOES BY SEPARATE CONVEYOR TO THE CUSTOMS HALL

On the "landside" of the passenger building lie the control tower (described on pages 565-566), car parks and a 2,000ft tunnel emerging south of the London-Bath Road. On the "airside" are glass-walled footbridges giving access to and from the apron. The space between the two sides contains the multiplicity of elements required "to provide for the handling of passengers and their luggage"—the counters; escalators; concourse; luggage conveyors; Customs, Immigration, Health and waiting rooms; shops; and restaurants. The flow of passengers and uniformed staff is never stilled and the loudspeakers are rarely silent.

"FLIGHT" drawings by GORDON HORNER

Airborne at last from Boeing Field, Seattle, is the first YC-97J, one of a pair of production Stratofreighters used by the U.S.A.F. for evaluation with 6,000 h.p. P. and W. T34 turboprops. First flight was on April 19th, the crew being Ed Hartz (pilot), H. S. McMurray and Don Kelley.

AIRCRAFT INTELLIGENCE

U.S.A.

Convair F-102A. This supersonic delta-winged intercepter has a single-point pressure-fuelling system. Accessory Products Corpn. have developed a new type of vent valve which permits very high fuelling rates while guarding against excessive tank pressures. The F-102A has integral tankage, which could be seriously damaged by over-fuelling or excessive pressure. The type is also equipped with a braking parachute, housed in a box with sideways-opening doors above the tail-pipe.

Douglas B-66. It is reported that a new version of this twin-jet tactical bomber and reconnaissance type is being developed, with a revised form of crew compartment and canopy, a later mark of Allison J71 (J71-A-11) and a different fuel system. This may be the "advanced model" of the B-66 which is to be built at the Tulsa, Oklahoma, factory.

Lockheed TF-104. It is now learned that this tandem-seat trainer version of the F-104 fighter will incorporate downward-ejecting seats. This has been rendered necessary by the height of the fin and "T-mounted" tailplane.

North American F-86H. A fighter/bomber version of the Sabre, now in production at Columbus and capable of carrying a heavier offensive load than any other Sabre, the "H" is one of the few manned U.S.A.F. production machines powered by the General Electric J73, of about 9,000 lb rated thrust. It is now proposed to improve performance by fitting a reheat tail-pipe with a Marquardt variable-area nozzle. This should result in a thrust of some 12,000 lb for limited periods. The earlier F-86F is also in production again, as a result of a recent U.S.A.F. order for 500. Most of these are expected to be issued to the German Air Force for day tactical fighter/bomber wings.

Service Designations. It is reported that both the U.S.A.F. and U.S.N. are attempting to formulate a common system of designating military aircraft. It has been suggested that the Air Force should adopt odd numerals—such as F-105—and the Navy the even numbers; such a system has long been used to designate the sub-types of U.S. gas turbines, so that, for example, the J65-W-1 and -3 are Air Force Sapphires, whereas the J65-W-2 and -4 are for the U.S. Navy. Even the basic engine type follows the same rule; thus the J65 (odd) was first bought by the Air Force, whereas the T34 (even) was originally a Navy development. Aircraft for the U.S. Army are bought through the Air Force or Navy, and would be designated according to the purchasing mediator. The U.S. Navy are said to be opposed to the projected scheme, since they would have to reorganize their whole designation code.

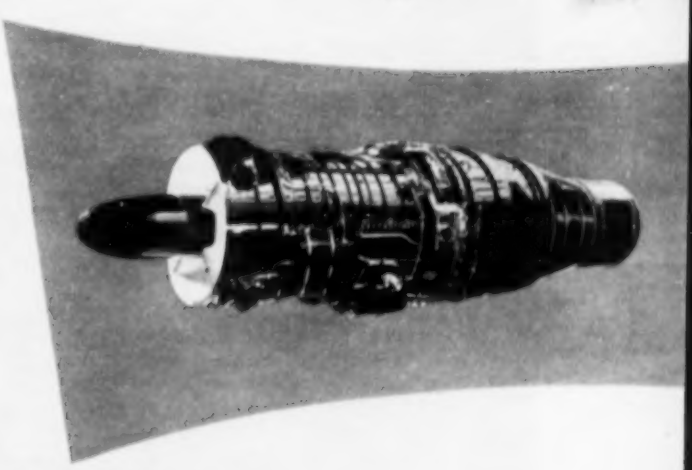
France

Potez 75. Well known to *Flight* readers as a specialized anti-tank aircraft, this twin-boom pusher machine is being adapted as a ground-attack aircraft for colonial use. The conversion was ordered by France's Under-Secretary of State for War, and entails the fitting of four 7.5 mm guns in the nose and eight under-wing rocket projectiles, in addition to the guided missiles already provided for. The seats are protected by armour plates, and a special patented device offers additional safety "comparable to the war-time flak suits." The machine is still capable of operating from any type of airstrip.

GRUMMAN S2F-1 SENTINEL
(Two 1,525 h.p. Wright R-1820-82)
Span 69ft 8in
Length 42ft 3in

The Power of Armstrong Siddeley

The Sapphire turbojet is already celebrated as the power unit for some of the world's most powerful fighting aircraft on both sides of the Atlantic. Now it is chosen to power the French Vautour S.O. 4050-03 bomber—claimed as the first bomber in the world to reach Mach 1. This is further evidence of the strategic importance of the Sapphire—and the almost universal power of Armstrong Siddeley aero engines.



ARMSTRONG SIDDELEY MOTORS LIMITED

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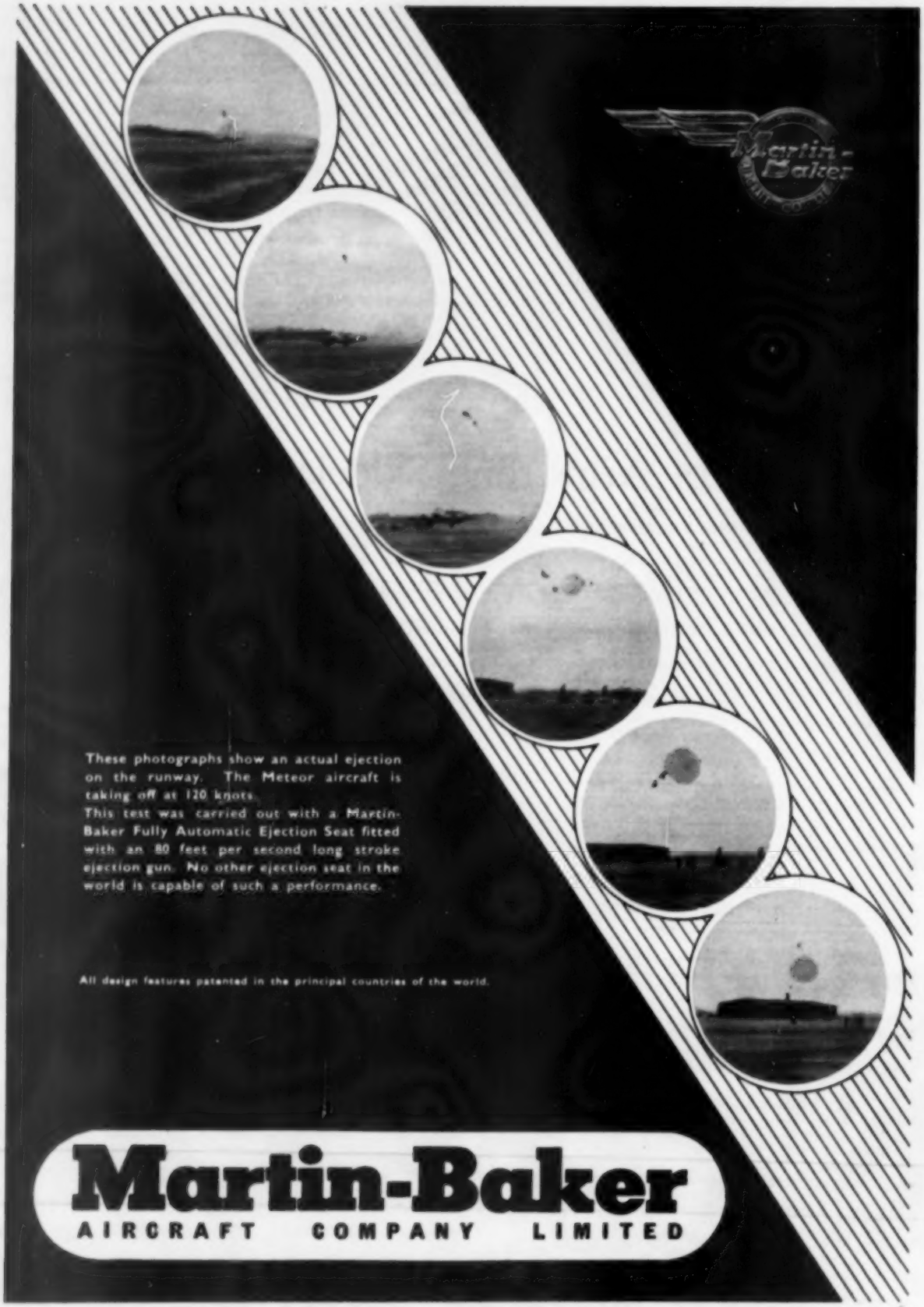
Members of the Hawker Siddeley Group



These photographs show an actual ejection on the runway. The Meteor aircraft is taking off at 120 knots.
This test was carried out with a Martin-Baker Fully Automatic Ejection Seat fitted with an 80 feet per second long stroke ejection gun. No other ejection seat in the world is capable of such a performance.

All design features patented in the principal countries of the world.

Martin-Baker
AIRCRAFT COMPANY LIMITED

The first—and so far the only — example of the attractive Morane-Saulnier M.S.760 Paris in flight. The additional fin area under the tail was originally added to the 760's predecessor, the Fleuret, in order to make it capable of spinning for training purposes.

ACTUALITÉS FRANÇAISES

Part 2: Around the Industry

By C. M. LAMBERT

DURING the first part of my visit to France, as related last week, I travelled down to the South of France and back to Paris. The week-end was spent mainly at Toussus-le-Noble and Buc, just outside Paris, watching a series of light and ultra-light aircraft being put through their paces, and an account of these proceedings will form the third instalment of this series. It was after the week-end that I was able to visit, in and near Paris, the series of companies described here, namely Morane-Saulnier, S.I.P.A., Marcel Dassault and S.N.C.A.N.

Morane-Saulnier. On the Monday I had lunch with M. Vichou, the head of the design department of Morane-Saulnier, at Puteaux on the outskirts of Paris. He told me something of the company's work and during a short tour of the experimental factory I was able to take a fairly close look at the M.S.760 Paris, a light communications four-seater powered by two Turboméca Marboré turbojets. This at the time was completely dismantled and undergoing the usual inspection and minor modification which take up a considerable part of a new prototype's life.

The Paris was directly developed from the M.S. 755 Fleuret side-by-side two-seat trainer. It may be remembered that the Fleuret went to India last year for service trials with the Indian Air Force. Contrary to expectations, no order resulted; nor did N.A.T.O. come to the rescue, for the Fouga Magister was standardized as the basic and intermediate trainer. The only Fleuret so far built has been acquired by the French Air Force and is based at Marignane. Translation from Fleuret to Paris was achieved mainly by removing the former's armament, redesigning the cabin floor to eliminate the downward ejection hatch, and moving the rear cabin bulkhead slightly aft at the expense of a little fuel-tank capacity. This lost capacity was made up by re-shaping other portions of the tank.

By all reports the Paris has lost none of the Fleuret's delightful flying characteristics, nor have its possibilities as a trainer been in any way prejudiced. An order for a hundred, to replace the Noralpha and the Norécrin, is expected from the French Government. If this is secured, the first production Paris will be due for delivery next January; a pre-series is under way.

Perhaps the most interesting news about the Paris, however, is the fact that Beechcraft have shown a very real interest in the type, presumably with a view to producing it under licence in America. M. Savarit, Morane director-general, has spent two months in America in connection with the project and I understand that Beechcraft have requested that the Paris should follow, there to undertake 500 hours' flying. The American company has also asked for the latest Marborés, of 450 kg (990 lb) thrust each, to be installed.

All-up weight of the Paris with four passengers and 30 kg (66 lb) of baggage, is 3,397 kg (7,470 lb) and its maximum speed 650 km/hr (400 m.p.h.). It climbs to 7,000m (22,900ft) in 18 min and at this height and at maximum continuous power has an endurance of 2 hr 45 min and a range of 930 miles. It carries 1,000 litres (220 gal) of kerosine in the single main fuselage tank and 250 litres (55 gal) in each tip-tank. These latter are not jettisonable, but electrically operated valves can be opened to dump fuel very rapidly. Flap, dive-brake and undercarriage actuation is by flexible shafts and Lear electric motors. The nose opens up, Vampire Trainer fashion, to expose radio, alternators, batteries and electric jack motors. A completely removable tail gives direct access to the engines, and the wings can be detached without the necessity for removing the undercarriage. The tailplane has electrically variable incidence, and the large main-canopy blister is a one-piece moulding 8 mm (0.31in) thick. The cabin is fully pressurized and air-conditioned.

M. Vichou said that the twin-Marboré formula had been found the best for the particular purpose; it would have required a turboprop of 2,000 h.p. to produce a comparable performance, and this would in any case have brought with it the added dimensional and mechanical complications of a fairly large airscrew. Had two small turboprops been used, the single-engine case would have been far less comfortable than with the Paris's Marborés, which are "toed out" and close to the centre-line.

In the experimental shop at Puteaux there was also one of the three M.S. 700 series twin-engined six-seat liaison aircraft, similar in general layout to the Twin Bonanza and designed with colonial operation in view. The aircraft was being overhauled and prepared for use as a company hack. One can expect other projects from Morane-Saulnier, but these, for the time being, must remain under the security veil.

A Visit to S.I.P.A. During the afternoon, I went to see the S.I.P.A. factory on the outskirts of Paris. Though the chief designer, M. Max Gardan, is one of the youngest designers in France—he is under 30—he has been responsible for a number of outstanding aircraft, notably the Sipa S. 200 and S. 300 and the Minicab and Supercab. He is tremendously energetic, determined and full of ideas. At the moment the factory is engaged in bringing up to Sipa S. 121 standard about 30 of the early Sipa trainers originally developed from the German Arado Ar 396. The French Air Force is reported to be most enthusiastic about this aircraft and to have requested that these early machines be brought up to the latest standard. This is being done on a production-line basis.

In addition, of the seven S. 200 Minijets ordered, two prototypes and three of the pre-series are complete and the last two of the pre-series await only engines and equipment. Of the latest development, the tandem two-seater S. 300, five have been ordered by the government and one has so far flown. This first aircraft is to go to the Centre d'Essais en Vol for tests.

Since he must have considered light fighters, I asked M. Gardan what his ideas were on the subject. He was perfectly confident that he could have produced a light fighter carrying two missiles and capable of either horizontal or vertical take-off with an all-up weight well below 11,000 lb. The main problem, he said, lay in adapting to the formula the latest techniques, principally concerned with equipment. In any case, he thought, design had not progressed far beyond the stage of the Messerschmitt 262.

But I heard that M. Gardan is at the moment concentrating on quite another type of project, the results of which may possibly be on view at the time of the Salon in June. I could not help feeling that if official assistance were forthcoming one could expect some most interesting designs from this source.

From the S.I.P.A. factory, I went up to Villacoublay and saw the first prototype S. 300. I was provided with a parachute and sat in the front cockpit and saw what an excellent job has been made of it. There is no superfluous room, yet nothing gets in the way of a comfortable sitting position and all controls and switches are laid out on two narrow consoles down the sides of the cockpit. Everything can be reached with the minimum of movement and the visibility, particularly over the nose, is excellent. Though the S. 300's engine is the same as that of the Minijet, the take-off is rather shorter.

For various reasons it was not possible for me to fly the S. 300 but I gladly accepted a second flight in the S. 200. I made a trip

ACTUALITÉS FRANÇAISES . . .

with Max Fischl in the second prototype last year and flew this time with M. Simon in F-WGVN, the third aircraft. Fischl, by the way, is now with S.N.C.A.S.O., and is testing the Trident.

There are a number of differences between the second and third prototype S. 200, most of them foreshadowed last year. The undercarriage and flap selector, still on the central pedestal, is now in the form of a four-position gate gear-change, and the hydraulic-pump handle is between the seats. Mechanical indicators are replaced by red and green lights. I had the impression that the canopy had been slightly raised to give a little more headroom. The instrumentation has been somewhat rearranged and is easier to read. A fairly large retractable tail bumper has been added under the jet-pipe so that, when empty, the aircraft can be left to rest tail-down instead of having to be propped up by a small wooden stool; it only assumes its true tricycle stance when the seats are occupied. Most of the test instrumentation has also been removed; and, while flying, I felt that the controls—particularly the ailerons—were a good deal more "solid."

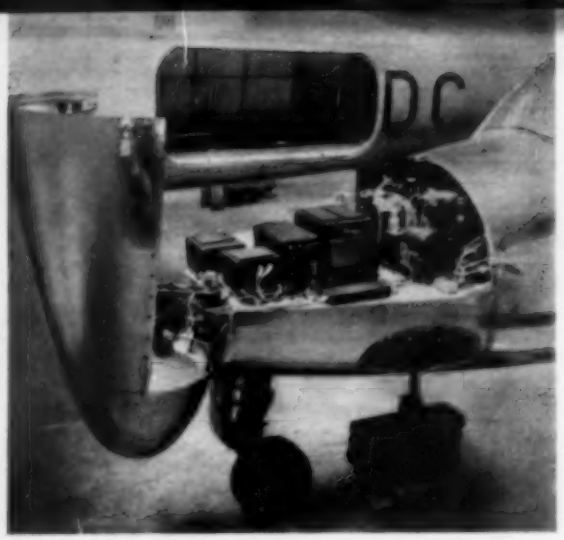
Last year, owing to a snag in the oil system, we were unable to apply any negative g and therefore could not really indulge in any aerobatics. This time there was no restriction and, in a 20-minute flight, we cavorted gaily about the sky over Villacoublay and I was able to gain a fairly good idea of how the aircraft handles. The take-off run took 20 sec to unstick at 69 m.p.h., and the distance covered with one Palas pushing two people was, I estimated, between 400 and 600yd. We climbed at 121-126 m.p.h. at 32,500 r.p.m. (take-off is at 34,000 r.p.m.) and cruised at 184 m.p.h. at about 4,000ft with 31,500 r.p.m. The stall, with the aircraft clean, comes at 63 m.p.h. indicated, with a slight wing-drop but an almost immediate recovery. I tried several rolls at about 172 m.p.h. and 25,000 r.p.m., and noticed that the nose dropped quite firmly as one came out into level flight again. To make a level roll, the nose must be raised quite considerably at the beginning, and a fair amount of top rudder used. Yet, while there is not overmuch power to spare, it is quite possible, according to M. Simon, to gain height during aerobatics.

When lowering flap I found that there is not enough elevator-trim to hold more than 20 deg of flap in a glide, but the stick forces after that are quite light. Undercarriage lowering and raising takes between 30 and 35 strokes of the pump. Forty degrees of double-slotted flap are available, but for normal purposes not more than 25-30 deg are recommended. M. Simon, however, showed me an approach with 40 deg of flap and engine throttled back. The angle of descent is extremely steep at 92 m.p.h. but the round-out is not unduly difficult and there is, of course, very little float. The landing run itself was quite short.

There is still one rather tricky point in the S. 200, namely, that the throttles on each side are placed very close to the hood-locking catches, and both are similar in shape; furthermore, both act in the same sense, i.e., forward to open, backwards to close.

The S.200 is a pleasant enough little aircraft but unfortunately rather too low on the ground for comfortable operation from the average grass field. It is probably partly to overcome this that the S.I.P.A. 300, with its longer undercarriage, was designed.

Calling on Marcel Dassault. On the Tuesday morning I paid a visit to the Marcel Dassault experimental factory at St. Cloud, on the banks of the Seine. The company is at the moment providing the backbone of the French Air Force's high-performance fighter force. Mystère IICs and IVAs, respectively powered by the Atar 101D and Hispano Verdon (Tay development), are



rolling off the lines at a formidable rate, and production of the IVA has caught up with that of the IIC. About half-a-dozen Mystère IVB1s are being built at St. Cloud and there is also an ordinary IVB (Rolls-Royce RA. 7R) in which a rocket motor is being mounted in the rear under-fuselage. This is an installation very similar to that projected for late-series Republic F-84Fs.

I was particularly interested in the IVB1, frequently referred to as the Super Mystère, because it is often claimed to be a direct competitor of the North American F-100. Although it does not equal its American counterpart in such qualities as range, and possibly in fire power (it has 2 × 30 mm cannon and rockets), it is remarkable that even so much could have been achieved on the comparatively modest thrust of an RA. 7R. The IVB1 differs considerably from the IVB since it has a thinner and more highly swept wing (45 deg at 25 per cent).

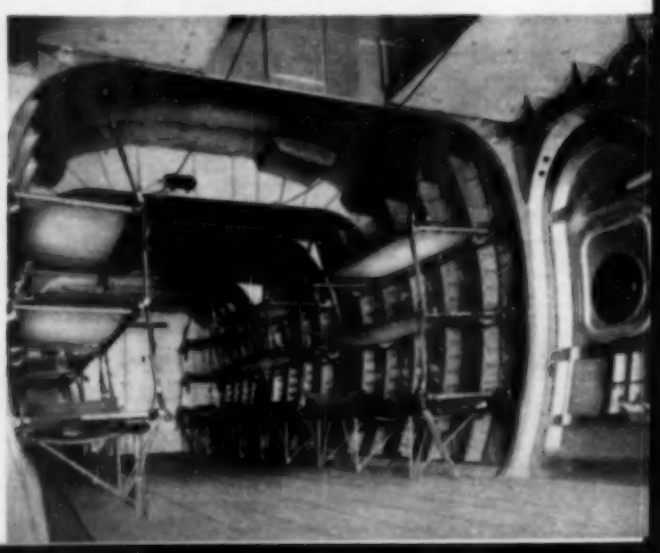
The armament, in conformity with present French policy, consists of just two 30 mm cannon, but there is in addition a retractable under-fuselage rocket-pack containing some two or three dozen ballistic air-to-air rockets, possibly of the Matra type. The air-intake has been flattened and an advanced radar gun-sight will be fitted, with its scanner "looking" through a dielectric panel in the upper lip.

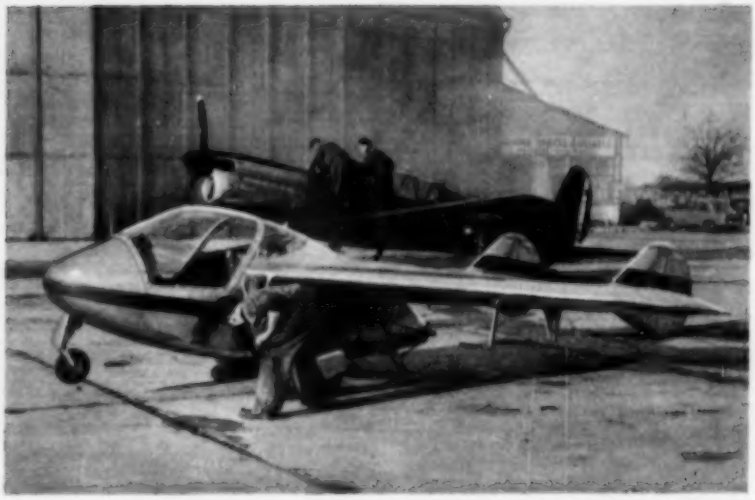
Production Super Mystères will be powered by the Atar 101G (and probably called IVB2s), and although there are no firm orders apart from those for a pre-series of ten, it is expected that 200 will soon be ordered. There are also definite indications of a sleek, small ground-attack fighter.

The Mystère IVA is being produced in four factories: forward fuselages by Marcel Dassault, Argenteuil, and by S.N.C.A.S.E., Toulouse-Blagnac; the wings by Marcel Dassault, Boulogne-sur-Seine; and tails and final assembly by Marcel Dassault, Bordeaux. I went to Argenteuil to see forward fuselages being turned out. These sections extend from the engine-access fuselage break forwards and are built up of five sections, two forward sides, two rearward sides, and the sealed cockpit in the middle. Particularly noteworthy is the fact that a fighter of this comparatively high performance makes so little use of forgings, which are not so readily available in France as they are in America or Britain. It is almost entirely made up of sheet-metal sections, there being only three or four forgings, all grouped at the wing-root junctions.

In the IVA, the air duct is split vertically and led round the

(Left) The cockpit of the prototype M.S.733 trainer, showing the single blind-flying panel (partly duplicated in production aircraft) and radio compass. One hundred and thirty of these aircraft have been ordered for the French Air Force and 100 delivered; six more are on order for Air France and seven, with two machine-guns each, for the government of Cambodia. (Right) The Nord 2501 prepared for casualty evacuation with 18 stretchers, seen through the rear loading doors. Visible on the right is the starboard of the two parachuting exits.





(Left) The nose-cone of the M.S.760 Paris opens to expose for easy servicing the radio, batteries and equipment. The oval hatch below gives access to the now empty gun-bay. Behind can be seen the cargo compartment in the after fuselage of the M.S.700 series aircraft which is being prepared as company hack.

The third prototype Sipa 200 Minijet at Villacoublay. It rests on its tail bumper until the pilot climbs in. In the background is a Sipa 121 trainer being prepared for a production test flight. "Flight" photograph

sides of the cockpit so that the nosewheel can retract into the space between. In the IVB the trunk is led aft, Sabre-wise, along the centre line and the nosewheel turns through 90 deg to lie flat after retraction. The fuel capacity is 2,100 litres (462 gal) and I was told that this is accommodated in seven tanks in each wing and two in the fuselage. A single electric pump at each wing-tip feeds fuel into the lower fuselage tank, whence it passes direct to the engine. The upper fuselage tank, meanwhile, also feeds into the lower one. With 620-litre (136 gal) under-wing tanks, the endurance for ferrying can be brought up to the region of three-and-a-half hours. The main hydraulic compressor for the powered controls, and a generator (complete with their drive gearbox), are mounted on the bottom of the engine compartment before the engine is installed; in fact all equipment except guns is put in before the fuselage (still engineless) leaves for Bordeaux.

The two 30 mm cannon, which from their attachment points appear to be of the standard French D.E.F.A. type, are mounted on their sides in the under-fuselage, by the cockpit, with the large ammunition-bay immediately behind the cockpit's armoured rear bulkhead taking almost the full fuselage depth. Shell cases are ejected, revolver-cannon-wise, backwards down a tube, while links are dropped out beneath the gun *via* an ingenious faired ejector slot which carries them clear of the under-fuselage.

I was told that no trouble had been experienced either with gas concentrations in the gun bay or with dumped links and (except with dive-brakes open) cases. Gun-bay ventilation is reported to be particularly good, since air enters at the gun port and is immediately vented from the bay by plain louvres.

The undercarriage and wheel brakes are by Messier and the ejector seat by S.N.C.A.S.O. On the IVA it is a conventional automatic seat built up mainly of steel-tube booms with sheet webs; the Super Mystère is to have a S.N.C.A.S.O. light-weight seat. For ground-attack duties, the Mystère IVA can carry two 620-litre (136 gal) wing tanks in addition to two bombs or 100-gal napalm tanks, and in this condition, I was told, it could exceed Mach 1 easily in a dive. The present rate of fuselage production at Argenteuil is eight per month and from the time that metal is first joined to metal, to the time when the forward fuselage is complete and ready for despatch to Bordeaux, five months elapse.

Much of Marcel Dassault design, particularly equipment, seems to be based to some extent on North American practice. For instance, the flying-control system of the Mystère IVA—and, I gathered, of the IVB also—is based on the F86E formula. It remains to be seen whether the spring-feel and bob-weight combination is still satisfactory for really high-speed aircraft of the Mystère IVB1 type. It is, however, impossible to carry this speculation further, since the Marcel Dassault factory has the most security-conscious organization I met in France.

By Norécrin to S.N.C.A.N. My final visit was to Bourges, about 100 miles south by east of Paris, where a large part of the Noratlas order is being fulfilled.

I went there with Jacques Noetinger in a Nord 1203 Norécrin, No. 326 (registered F-BBEL), powered by a S.N.E.C.M.A.-Régnier 4LO of 140 h.p. This was my first experience of the Norécrin but, though I flew it for almost an hour, I would not like to pass any particular judgment on it because we flew in violent turbulence which would have upset the handling characteristics of almost any aircraft.

The instruments consist of a plain magnetic compass, a V.S.I. (metres/sec), an altimeter (kilometres), an A.S.I. (km/hr), a ball slip-indicator, r.p.m. gauge, and oil pressure and temperature and fuel-pressure gauges. The fuel gauge, a glass tube low down on the starboard wall of the cockpit, gives a direct reading of the level. There are toe-brakes, mechanical flaps, and a hydraulic undercarriage retraction mechanism worked by a hand pump with twist-grip selector. The throttle control is a long push-rod in the centre of the panel.

The Norécrin has a pronounced swing on take-off and use of both brake and rudder are required up to 100 km/hr (62 m.p.h.). Our port wheel brake was none too good, but luckily the swing was to the left and the starboard brake held. We flew to Bourges at just under 1,000ft, 2,000 r.p.m. and 220 km/hr (137 m.p.h.), avoiding a series of heavy showers but meeting turbulence which obliged us both to keep our seat-belts fastened throughout the journey. Several times we banged our heads smartly against the canopy, and in particularly rough patches we throttled back to spare the airframe as much as possible. In these conditions it was rather difficult to hold a course with a plain compass.

The landing at Bourges was uneventful enough. The undercarriage came down at 150 km/hr (93 m.p.h.) with 42 strokes of the pump, and we crossed the hedge at 120 km/hr (75 m.p.h.) and touched down at 110 (68 m.p.h.). As we reached the apron, however, we were caught in a 50 m.p.h. squall, with hail and rain, and spun smartly into the wind as the lack of port brake left us out of control and unable to taxi. Some men sallied forth into the storm to hold the wing-tips and thus we taxied straight into the hangar and switched off as they slammed the doors behind us. Some Noratlas on the apron, meanwhile, rolled and pitched ponderously on their oleos as the gusts caught them.

The storm lasted only about ten minutes and we soon moved to the offices, where we talked to M. Lefébvre, chief of production. The Noratlas is going well and the 67th aircraft was complete at the time of our visit. The first French Air Force order had been for 80 and a second order for 40 had soon been placed; a third was now expected for about 60 .

Final assembly is concentrated at Bourges, and Les Mureaux, nearer Paris, with three aircraft rolling out from Bourges for every two from Les Mureaux. Total production is at the rate of two or three a month but there has been a slight drop while the S.N.E.C.M.A. licence-built Hercules were phased in. The Rotol airscrews are being produced by Bréguet. In addition to the Noratlas, the N.C. 856 artillery spotter is being built at Les Mureaux and, of course, the Noralpha and Norécrin are once more going into production. About 25 Noroits twin-engined amphibians were produced a few years ago for the Aéronavale and some of these have been modified for a radar scanner in the nose. It is also possible that Nord will take over the overhaul of the Meteor night fighters in service with the French Air Force.

While at Bourges, I spent an hour flying the Noratlas and found it an extremely pleasant and well-arranged aircraft. U.A.T. has two civil passenger/freight Noratlas in Africa and is waiting for delivery of a further 42-passenger version. The aircraft is apparently extremely popular with them; and after having flown it I could well understand why.

The all-up weight of the Noratlas has now been increased from 20 tonnes (44,092 lb) to 21 tonnes (46,297 lb), with an empty weight of 13.6 tonnes (29,980 lb). Though very similar in layout to the Fairchild Packet, it is a rather smaller aircraft and not quite so ambitious. But it has already established, among pilots, an excellent reputation. Its range is 2,500 km (1,553 ml) (this can be increased for ferrying to 4,500 km (2,796 ml) with extra tankage in the freight cabin) and the payload is 16,530 lb.

With just enough time before nightfall, we took off once more in the Norécrin for Toussus-le-Noble, encountering this time even worse weather than before. As we forced our way through a lighter patch in a lowering rainstorm, we were treated to a rare sight—a complete, very bright double rainbow which hung for some minutes round our starboard wing-tip. But at Paris the weather was clear and, now without our port wheel brake, Jacques made a perfect landing dead into the wind across the now-deserted Toussus airfield. My tour was complete. The following morning I entrusted myself gratefully to the B.E.A. Silver Wing service—though by then so tired that I refused my second (plastic) glass of champagne, and slept.

SILENCING JET HELICOPTERS

A Notable Paper by Professor E. J. Richards

AS briefly recorded in *Flight* last week, a paper entitled *Noise Problems in Helicopter Design* was presented by Professor E. J. Richards, M.A., Professor of Aeronautics, Southampton University, at the final 1954-55 meeting of the Helicopter Association, held on April 15th. Dr. G. S. Hislop was in the chair.

The lecturer began by describing the work which had already been carried out on orthodox piston-engined helicopters. So far as internal noise was concerned, B.E.A. had stipulated their requirements for passenger comfort (Fig. 1) based on fixed-wing experience. A study of internal noise level measurements (Fig. 2) showed that in present helicopters, without engine-exhaust silencers, a reduction of some 20 decibels was needed. This could be achieved partly by soundproofing and partly by reducing external noise.

To establish a criterion for the maximum acceptable external noise was not easy without operating experience in city centres. Dr. R. H. Bolt of the Massachusetts Institute of Technology had put forward a series of curves (Figs. 3a and 3b) indicating the response of American communities to objectionable noises; these could be used as a guide. In this respect, some tests carried out at the Houses of Parliament with a Bristol 171 helicopter (Fig. 4) were interesting. Measurements of the overhaul sound level were made which represented approximately the octave band sound pressure levels of 150 c.p.s. It could be seen from the curves that the noise level in the Chamber was acceptable while that in the committee room was not. For the purpose of standardization, it had been decided that, unless otherwise stated, noise levels should be measured at a distance of 200ft from the source.

A further series of tests, to determine the source of the greatest noise, had been carried out by Dr. N. Fleming, of the National Physical Laboratory, on the Bristol 173 helicopter. To separate exhaust noise from rotor noise, tests had been made with a single rotor on the spinning tower. There had followed further tests with the helicopter suspended on a gantry, the blades being replaced by paddles. Later, continuous recording tests on the actual machine in flight had been made (Fig. 5). For comparison with these figures for the 173 helicopter, the maximum recorded noise levels measured on the Bristol 171 were included on another graph (Fig. 6) which also showed the effect of height and distance on the reduction of noise.

An analysis had shown that the noise could be appreciably reduced by silencing the engine exhausts. At the distance of 200ft, and for the power used in the 173 helicopter (i.e., two engines each developing 400 h.p.), spectra of noise pressure levels as shown in Fig. 7 might be expected if silencers were fitted. It could be seen that even these required a marked reduction.

Direct evidence of the efficacy of exhaust silencing was derived from comparative tests carried out on the Westland WS-55 Whirlwind (Fig. 8), with and without the Vokes silencer fitted. From these tests it could be seen that a reduction of some 12 db had been achieved and it might be concluded that such silencers would be fitted on future orthodox helicopters. Rotor blade and gearbox noise was of a much higher order than was generally appreciated (Fig. 9). The curve for basic rotor noise (Fig. 7) showed that a reduction of some 20 db was required to bring down the level below the point of serious interruption, but this would be most difficult to achieve. While it might, perhaps, be feasible to effect some improvement by the use of boundary-layer suction in the blade design, it was unlikely that designers would be in a position to adopt such a principle for many years.

In jet helicopters, the gearbox noise would, presumably, be eliminated, but there was little point in attempting to reduce the noise of the jets to a level below that of the threshold of blade noise. The immediate problem, then, was to find a means of reducing the tip-jet noise to the level of the basic rotor noise curve, a reduction of approximately 15-20 db. The source of the noise was turbulence at the jet outlet and combustion. Aerodynamic noise from tip jets emanated in three ways:—

(i) as a simple acoustic source on a pulse jet of frequency equal to that of the pulse and of a mean noise level given by

$$Db = 10 \log_{10} \frac{1}{32} \frac{\rho_0 c}{r^2 c^2} (V_{max} - V_{min})^2 f^2 s^2 \times 10^9 \text{ above } 10^{-16} \text{ watts/cm}^2$$

where ρ_0 is the ambient air density, c is the velocity of sound and V that of the jet, of exit area s. The frequency is f, and r is the distance from the source.

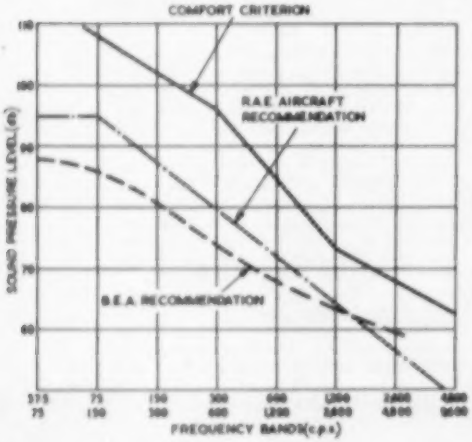


Fig. 1 (left) Helicopter internal-noise recommendations.

Fig. 2 (right) Measured noise levels inside helicopters.

	Alt. ft	Eng. r.p.m.	Boost in	I.A.S. kt
Bell 47	750	3,100	19	50
S-55	450	2,250	27	72

Fig. 3a Relation between community response and composite noise rating. Fig. 3b Composite noise rating.

Fig. 4 Helicopter noise in Houses of Parliament; aircraft proceeding in up-river direction at 500ft.

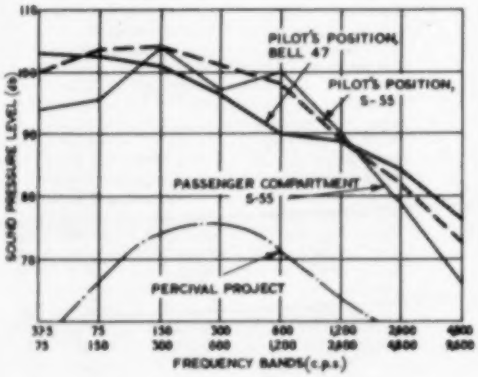


Fig. 4

Fig. 3a

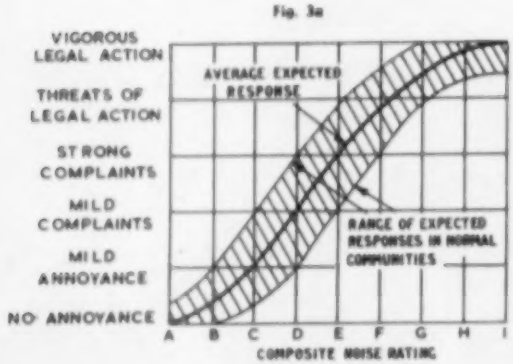
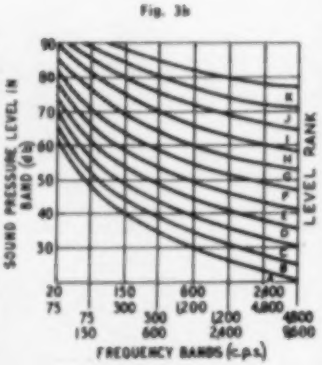
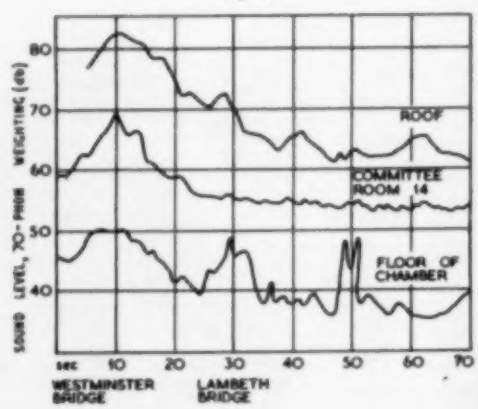


Fig. 3b





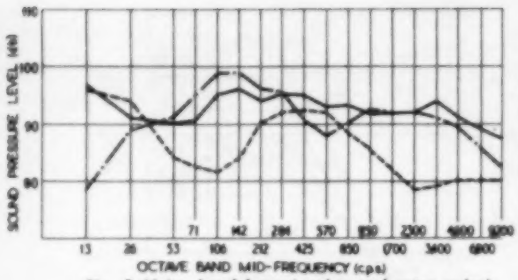


Fig. 5 Noise breakdown (engine and rotor noise).
Helicopter hovering, 3,000 r.p.m.
Engines (gantry, 3,000 r.p.m.)
Estimated rotors only 3,000 r.p.m.

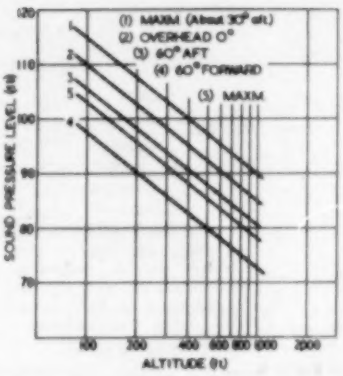


Fig. 6 Noise attenuation with vertical distance of helicopter. (1) Max. (about 30° aft), (2) overhead 0°, (3) 60° aft, (4) 60° forward, (5) Max.

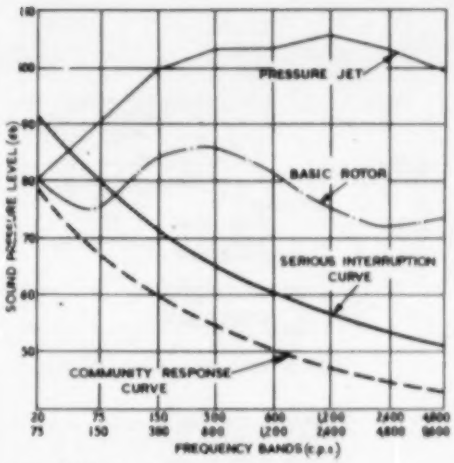


Fig. 7 Noise levels required and achieved.

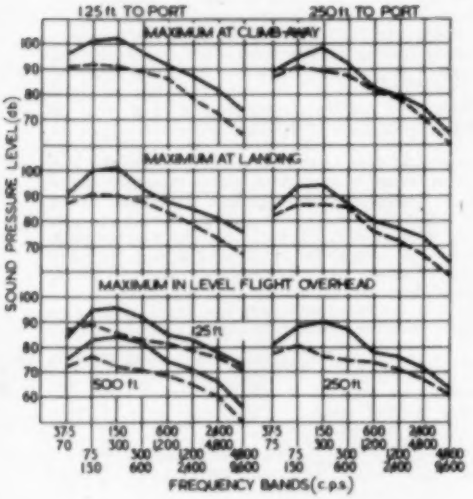
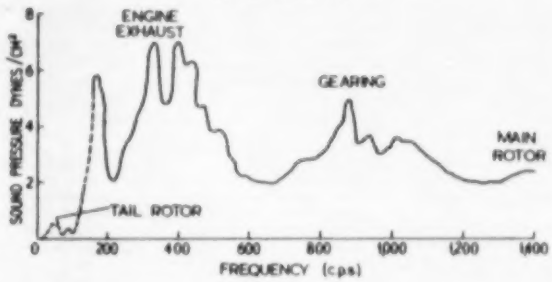


Fig. 8 Noise reduction on S-55 with exhaust silencer.
With silencer. Without silencer.

Fig. 9 Noise from helicopter in hovering; frequency analysis with 20 cycle-wide filter.



(ii) on continuous jets, noise arose from the turbulence and varied for a jet as $\rho \frac{V^8 d^2}{c^5}$

where V is the velocity of the jet relative to the outside air, d is its diameter, ρ is the density of the outside air and c is the speed of sound in it. The constant of proportion could be obtained by reference to the graph (Fig. 10), which gave a correlation between a wide range of experimental results.

(iii) when, as in the case of the pressure-jet and ramjet, the nozzle was well choked and a high supersonic velocity was developed aft of the nozzle, a great increase of noise over and above law (ii) could arise from interaction of the turbulence with the standing shock pattern. There was, however, little or no evidence of this type of noise on rotor tip jets.

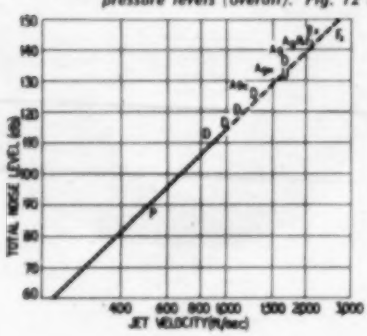
Combustion noise could take two forms. The first consisted of noise from the increased turbulence in a rough-burning jet and the second from a definite resonance in the jet-pipe. While there was no evidence of this latter note being present in small tip-jets, there was a considerable increase in noise resulting from burning generally. An investigation had been carried out to compare the noise spectra from a cold jet with similar figures at comparable thrusts on a pressure jet of the same diameter. It was found that general increases of some 7-9 db arose when the jet was burning fuel and was hot. Initial turbulence, i.e., turbulence caused by bends in the blade ducting system before the air reached the combustion chamber, could also be a source of noise. Noise increments of as much as 10 db had been measured on a rig having a double bend in the air duct.

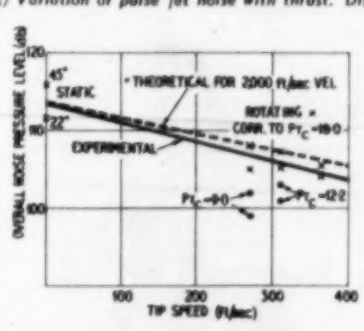
A consoling feature of tip-jet noise was that some reduction of the overall noise level had been found to result from rotation effect (Fig. 11). On high-velocity pressure jets, a reduction of 6-7 db had been measured at a tip speed of 400 ft/sec, while on the lower-velocity exhaust jets an even greater reduction should be gained. Theoretically, the figure for exhaust jets was 14 db. Rotation effect would be partly offset by the increase in the number of jet units on the actual rotor according to the number of blades. However, it did allow the figures obtained for the single pressure-jet unit to be taken as a reasonable measure of the noise at 200ft from the actual helicopter. A further reduction in combustion noise should be possible by designing the jet units for improved combustion while not increasing turbulence.

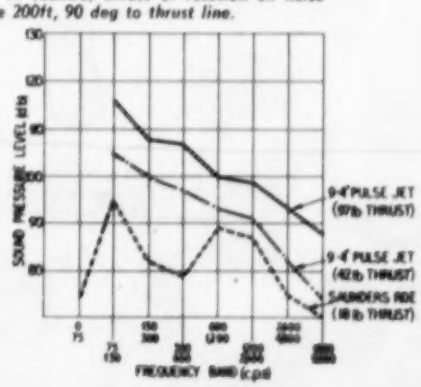
Much work had been done in Great Britain and the U.S.A. to determine the noise characteristics of both pulse- and pressure-jets. No information was available for ramjets but they would conform to the same pattern basically as for pressure jets with the same relevant pressure ratios. The results obtained with pulse-jets (Fig. 12) were not yet conclusive but it appeared that the predominant noise was that of the pulse and that some attenuation could be achieved by suitable matching of units in phase.

In the case of pressure jets, reference could be made to an extensive series of tests carried out by the Fairey Aviation Company (Fig. 13) and by the N.P.L. The tests had consisted of an

Fig. 10 (left) Total noise level at 30 deg reduced to distance equalling 24 rotor diameters. Fig. 11 (centre) Effect of rotation on noise pressure levels (overall). Fig. 12 (right) Variation of pulse jet noise with thrust. Distance 200ft, 90 deg to thrust line.







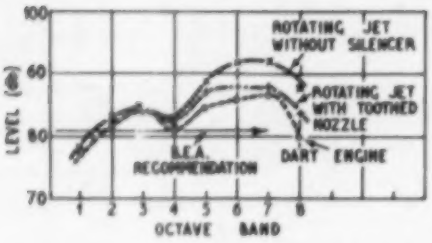


Fig. 13a Noise level on Fairey pressure jet.

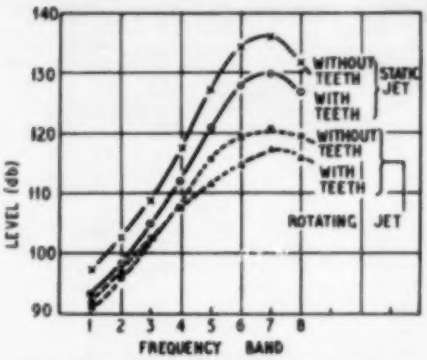


Fig. 13b Noise levels from static and rotating pressure jets at comparable powers and at a distance of about 6ft from nearest point in jet periphery.

SILENCING JET HELICOPTERS . . .

examination of the effect of varying fuel/air ratios in the combustion chamber and the effect of the whole range of silencing devices (Figs. 14 and 15). There was little purpose in referring to the former tests in detail, since the results showed that for a constant combustion-chamber pressure the overall noise levels remained substantially constant over a wide range of fuel/air ratios. These results had to be treated with some reserve, however, as any variations in fuel/air ratio made a large difference to the temperature, and thus to the density of the mixture.

The results obtained with the various silencing devices attached to the jet nozzles (Fig. 16) showed that the greatest reduction in overall noise had been achieved with the cross-tail silencer—though only with a thrust loss of 12 per cent, which was unacceptable for practical purposes. Another device which showed promise for the future was the corrugated nozzle (Fig. 17) which had been brought to a highly developed state by Dr. F. B. Greatrex of Rolls-Royce.

The lecturer concluded by describing a new form of pressure- or exhaust-jet nozzle (Fig. 18), investigated at Southampton University, and from which the gas was discharged through an annular outlet. Some tests had been made at the University with such a device, using cold air having little initial turbulence and no combustion noise. It was anticipated that the thrust loss with the annular jet would be small and the noise reduction achieved in the preliminary tests was most encouraging (Fig. 19). A logical development from this would be a two-dimensional jet (Fig. 20).

In this last-mentioned type, with a thin corrugated outlet, the noise pressure levels should be well down to the threshold of the basic rotor noise. Considerable performance advantages might also be obtained if this type of jet were deflected down through an angle of, say, 40 to 50 degrees. It might even be possible, with the resultant increase of lift on the retreating blade, to do away with the necessity for cyclic- and collective-pitch change. Much work remained to be done, but the low-velocity exhaust jet should be regarded with favour as far as noise was concerned, and tip-jet problems in general were not insurmountable.

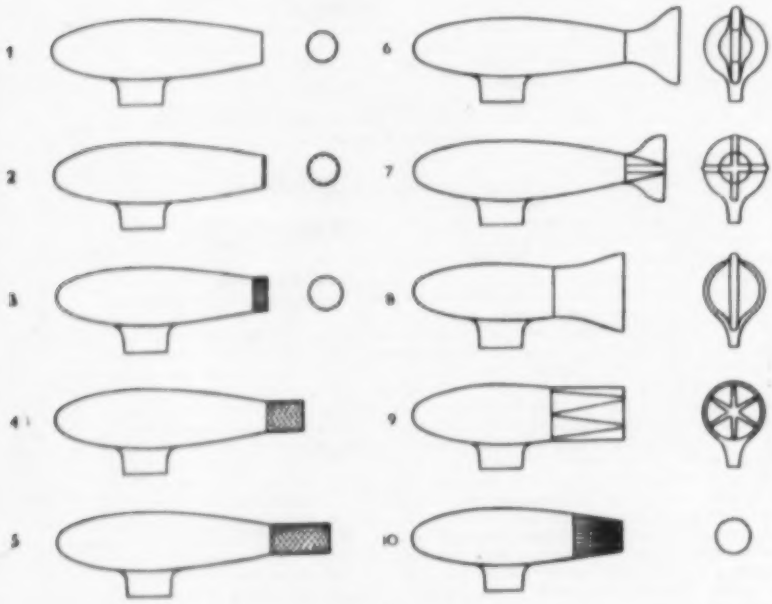


Fig. 14 Silencing devices for combustion chamber (as tested in third range of tests on the Fairey Company's static rig):— 1, Jet unit without silencer; 2, tooth silencer, ¼in × ¼in tooth; 3, flute silencer No. 1; 4, gauze silencer; 5, ducted gauze silencer; 6, fishtail silencer; 7, crosstail silencer; 8, fish-cone silencer; 9, star-cone silencer; 10, flute silencer No. 2.

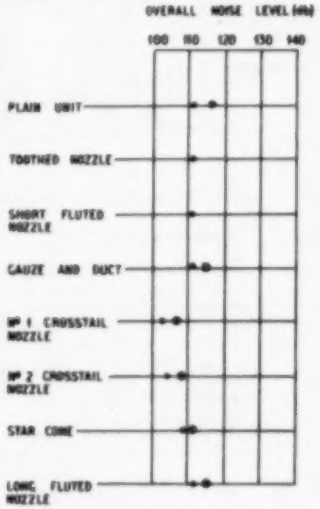
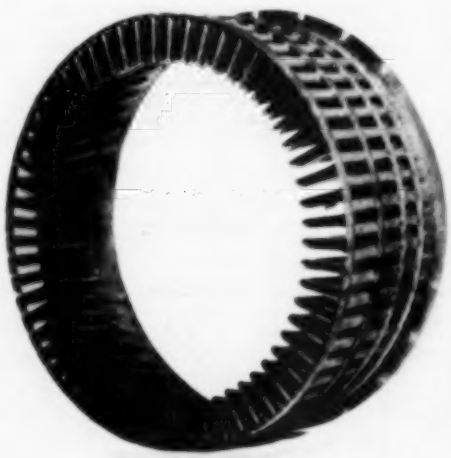


Fig. 16 Overall sound levels with various silencers. Distance 200ft (o = 45 deg to axis; • = 22 deg to axis). Thrust loss (per cent):— Plain nozzle, 0; fluted nozzle, 2.8; toothed nozzle, 2.5; plain nozzle, 0; gauze and duct, 3; crosstail No. 1, 12; star cone, 5; plain gauze, 3.

Fig. 15 Early Fairey devices tested.

Fig. 17 (right) Rolls-Royce corrugated nozzle.



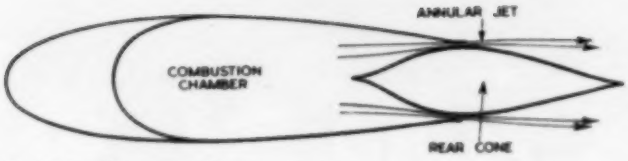


Fig. 18 Annular pressure jet.

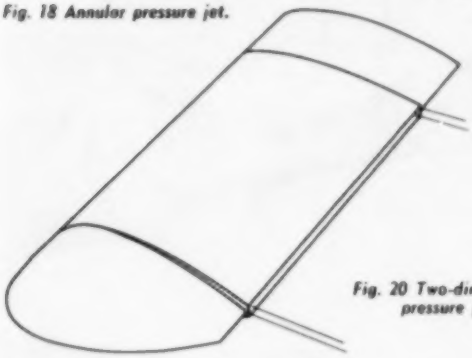


Fig. 20 Two-dimensional pressure jet.

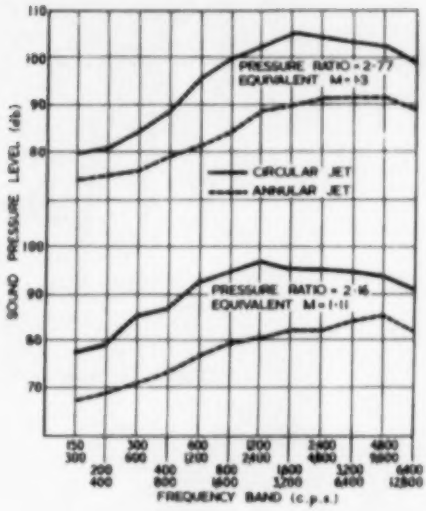


Fig. 19 Noise reduction with annular pressure jet. (Southampton tests.)

THE DISCUSSION

Dr. F. B. Greatrex (Rolls-Royce) congratulated the lecturer on presenting an excellent paper which would be the classic reference on the subject for some time to come. He said that, with airscrews, a reduction of disc loading was effective in reducing noise and wondered whether this could be applied to helicopters. He thought that the 12 per cent thrust loss experienced with the cross-tail silencer was due to the sudden change of shape at the cross-tail and could be eliminated by careful design. The principle was not unlike that of the corrugated silencer which was very selective in the frequency at which it was effective, according to the number and size of the corrugations. His company had achieved a 12 db noise reduction, with no thrust loss, by using this device on a jet engine.

Mr. G. H. Vokes (Vokes, Ltd.) did not think that the direct measurement of two superimposed noises of different forms necessarily reflected the true effect on the human listener. The exhaust noise was a much harsher sound, whereas blade noise was not so objectionable.

Mr. A. Stepan (Fairey Aviation) thanked the lecturer for many useful suggestions. He felt that while it might be difficult to reduce substantially the overall noise level of pressure-jets, an advantage might be gained by changing the burning pattern in such a way that the noise was shifted to a higher frequency. In this way a greater attenuation at distances would be achieved since it was well known that a high-frequency sound was less unpleasant than a low frequency.

Mr. R. H. Whitby (B.E.A.) found it difficult to believe that the basic rotor noise was as high as had been shown on the curves. He had never found blade noise unpleasant and wondered whether (a) the curve of acceptable noise was at fault or (b) the method of derivation of rotor noise was, perhaps, incorrect. On the WS-55 the noise level was 10 db lower on that side of the helicopter opposite the exhaust outlet, even when not fitted with a silencer.

Mr. G. M. Lilley (College of Aeronautics) suggested that the use of a number of smaller jet units on each blade might be a better solution than the use of one large unit as at present. He also asked why the lecturer had not made more reference to any problems which might arise from the use of higher tip-speeds, as supersonic blade-tip speeds had been thought by some to improve helicopter performance.

Mr. J. Wootton (Hunting Percival) agreed with Mr. Whitby that the rotor blade noise was not unpleasant. The design tendency was, he said, for disc loadings to be increased but, with the application of free-turbine engines to helicopters, some reduction in noise levels could be made in the hovering case by reducing the tip speed in this flight condition. The tests so far carried out on his company's project had shown that the machine would not be noisy in operation, a feature which he attributed to higher mass flow and reduced exhaust-jet velocity.

Mr. B. H. Arkell (technical author) asked whether, in view of the similarity between the lecturer's proposed two-dimensional tip-jet unit and the new Marquardt ramjet booster for helicopters, there were any figures available for comparison between the noise level of this latter unit and conventional jet units of similar thrust.

Professor Richards, in reply to the discussion, affirmed his faith in the noise measurement figures used as being a sound foundation on which to base the investigations. He agreed that the thrust loss on the cross-tail silencer could probably be obviated by a cleaner design. On the question of combustion noise, so many parameters were involved that it was difficult to make generalisations. A device to introduce swirling into the combustion chamber for better mixing had been tested and the resulting noise had been "terrific." Raising the noise frequency was a good suggestion—as, also, was the possibility of using a number of smaller jet units in each blade in place of the single larger unit. He was horrified at the thought of helicopters having supersonic blade-tip speeds. A project for a supersonic airscrew had been abandoned because its noise level would have been higher than that of a reheated jet engine. He had no information on the noise level of the Marquardt ramjet but he thought that this type of design was on the right lines to achieve the maximum possible noise attenuation.

ROCKET-MOTOR COOLING

AT the British Interplanetary Society's meeting on April 2nd, Mr. H. Ziebland, a Government scientist, spoke on *Heat Transfer Problems in Rocket Motors.*

Many of the failures in rocket motors were due to faulty cooling, said the lecturer, and the assessment of heat transfer was a most important matter. Unfortunately both basic theory and research were lagging far behind the application, and as a result the estimation of heat transfer was a very approximate process. So far the temperatures and velocities obtaining in rocket motors had not been encountered in other processes and consequently existing data had to be extrapolated a great deal to meet rocket requirements. Furthermore, the theory in general use had been based on approximations which were far from true.

It was in the transfer of heat from the combustion gases to the chamber walls that the greatest unknowns existed. The two processes of importance were convection and radiation, and large errors in computation could occur in both. The amount of radiation from gases depended on their temperature, pressure and the "path length," a dimension proportional to the chamber diameter. Gas emissivities had only been determined for temperatures up to 1,300 deg K and pressures up to one atmosphere, and usually these figures were extrapolated to rocket conditions.

The errors arising were large, but in small rocket motors using fairly low temperatures the radiative component was appreciable only in the combustion chamber and, even then, amounted only to a few per cent of the total heat transfer. With larger motors and higher temperatures and pressures this component became progressively important and further investigation was essential. Only two attempts at measuring the emissivities of actual rocket gases had been reported and both of these indicated that the true emissivities were up to twice as great as those predicted by extrapolating existing experimental data.

Forced convection had already been very widely studied because of its varied commercial applications, but the processes involved were very complex and still not completely understood. The usual theory assumed fully developed pipe-flow, a small temperature difference between the gas and the wall and no variation of gas properties with temperature. These assumptions were far from reality and, as a result, calculated values could be as much as fifty per cent lower than the experimental values. Various corrections could be applied, but more experimental results under closely controlled conditions were needed.

A further phenomenon, known as dissociation, caused enhanced heat transfer when hydrogen-rich fuels were used at high combustion temperatures. This was the splitting up of gas molecules into simpler species, in particular molecular hydrogen to atomic hydrogen. The atomic hydrogen diffused rapidly into the boundary layer, where it recombined into molecular hydrogen, releasing heat and producing a high temperature zone which led to the increased heat transfer.

The transfer of heat from the chamber wall to the coolant presented few problems, said Mr. Ziebland, although one interesting phenomenon—"nucleate boiling"—did occur. When the coolant temperature exceeded the local boiling point at the wall surface individual bubbles detached themselves from the wall, and at the same time there was a marked increase in the heat-transfer coefficient. It was thought that this played an important part in many rocket-motor cooling systems.

Standard Beardmore-built 2F.1 Camel, showing arrangement of the armament and the external control levers for the elevator cables.

SOPWITH CAMEL PART 2

HISTORIC MILITARY AIRCRAFT No. 10

By J. M. BRUCE, M.A.

THERE are indications that a few F.1 Camels may have been used from ships and even from the towed lighters mentioned later. Be that as it may, another version of the Camel was designed specifically for use from ships, and differed sufficiently from the standard machine to be given a new Sopwith type number: it was the Sopwith 2F.1. The prototype 2F.1, numbered N.5, was tested as early as March 1917. It was powered by the 130 h.p. Clerget, as were the first production 2F.1s.

The Sopwith 2F.1 was distinguished from the F.1 by a fuselage which was made in two parts: the division occurred one bay behind the cockpit, and at that point the rear portion of the fuselage could be completely detached. The object of the divisible fuselage was, of course, to economize in space on board ship. The necessary modifications to the controls resulted in the appearance of external rocking levers for the elevator controls, immediately behind the division in the fuselage.

The centre section of the 2F.1 was of shorter span than that of the F.1, and reduced the overall span of the aircraft by about a foot. The lower mainplanes were correspondingly shorter. The centre section was supported on steel-tube struts which, in front elevation, were splayed less sharply than the spruce struts of the F.1 Camel; they were noticeably more slender than those of the F.1 and provided a useful distinguishing feature.

One of the more important duties of shipboard fighters of the period was to attack enemy airships, not only those which raided the United Kingdom but those which performed the tactically more important tasks of scouting for and protecting German naval units. For these attacks the R.N.A.S. favoured upward-firing guns, and the armament of the Sopwith 2F.1 was arranged accordingly. A single fixed Vickers gun was mounted on top of the fuselage, to port of centre; and a Lewis gun was carried above the centre section on a mounting which enabled the weapon to be swung back for reloading and for upward firing. The structure of the centre section differed from that of the F.1 Camel to permit the gun to pass through the central cut-out.

Experimental Camel 2F.1 at Felixstowe, with twin-Vickers-gun installation and steel-tube undercarriage.

The Sopwith 2F.1 Camel was flown from ships in the same way as the Pup, which it largely supplanted. A short runway, little more than twice the Camel's own length, was built on the forecastle of some of the light cruisers, but many had a platform built on top of a gun-turret. A rather longer run was provided on battle cruisers by similar platforms on gun-turrets. In all cases the tail-guide trestle first used for the Sopwith Pup was fitted. The 2F.1 was also flown from the aircraft carriers *Furious*, *Pegasus* and, later, *Argus* and *Eagle*.

On June 1st, 1918, during one of the sweeps made by the Harwich Force, the Camels of the Australian light cruisers *Sydney* and *Melbourne* took off to attack enemy seaplanes: Lt. A. C. Sharwood of the *Sydney* forced one down on the sea, but machine-gun trouble made it impossible for him to follow up his attack. Two Camels from *Furious* attacked two German seaplanes in the Heligoland Bight during a reconnaissance operation by the First Light Cruiser Squadron on June 17th. Lt. G. Heath forced one of the enemy down on the sea; the seaplane was later sunk by the destroyer *Valentine*.

One of the most daring uses of Sopwith 2F.1 Camels was their operation from lighters towed by destroyers. These lighters had been developed for the transportation of flying-boats across the North Sea in order to increase their radius of action. By using them to carry single-seat fighters the Admiralty was provided with a means of making daylight attacks on Zeppelins over the North Sea and on enemy seaplane bases.

The first attempt to fly a Camel from a lighter was made by Col. C. R. Samson on May 30th, 1918, and it nearly cost that gallant officer his life. There was no proper flying-off deck, the take-off device consisting of a pair of troughs running the full length of the lighter. The Camel which Samson used had been specially fitted with twin skids instead of wheels, in the same way as the Sopwith 9901a version of the Pup, and these skids ran in the troughs. Samson resorted to this arrangement partly to enable the experiments to be conducted as quickly as possible, and partly to ensure that his Camel would keep straight and not fall over the side of the lighter before it was properly airborne. The trial was carried out off Orfordness; and on board the towing destroyer *Truculent* was Lt-Col. E. D. M. Robertson, the officer commanding Felixstowe air station.

With the lighter under tow at 32 knots, Samson started to take off, but the Camel's skids jumped from the tracks in the lighter's

deck. The machine fell over the bows and was run over by the lighter. Maj. Egbert Cadbury, D.S.C., D.F.C., was on board the lighter, and his description of what followed appears in these words in "The Story of a North Sea Air Station," by C. F. Snowden Gamble (p. 393):—

"I gasped, and could not believe it possible that Samson could avoid being battered to atoms. It was all over in a second, and before I had regained my legs, the wreckage of the machine was 300 or 400 yards astern, and no Samson. Suddenly, up bobbed a little white flying cap, and all heaved a sigh of relief.

"An escorting destroyer had got a whaler away in about 30 seconds, and picked him up. He was unhurt, but had had a nasty time under the water disentangling himself from the wires of the wreck. The first thing he said as he ran nimbly up the side of the destroyer was, 'Well, Robertson, I think it well worth trying again. . . .'"

On that occasion Maj. Cadbury had acted as a human tail-guide trestle for Samson's Camel: he lay on his back and lifted the tail of the machine with his feet.

Despite its premature termination, this first trial provided useful experience, for it showed that the lighter rode stern down when under tow at speed. Since the staging which carried the trackway had been fitted parallel with the water when the lighter was at rest, the Camel had to attempt to take off from what was in effect an uphill runway. A full-size 30ft flying deck was therefore fitted and was arranged to slope down towards the bows at such an angle that it was horizontal when the lighter was under tow.

The tracks were discarded, and the next test was made with a Camel which had a wheel undercarriage. On July 31st, 1918, Lt. S. D. Culley made a successful take-off from the lighter, and the practicability of the scheme was proved.

When the Harwich Force set out for the Heligoland Bight on the evening of August 10th, 1918, three of the destroyers towed lighters carrying flying-boats and a fourth (*Redoubt*) towed a lighter with a Camel on board. The machine's pilot was again Lt. Culley. Early in the morning of August 11th the force was off Terschelling, and six coastal motor boats set off in search of enemy vessels. The flying-boats were prevented from taking off by a long, smooth swell, the absence of any wind, and an overload of fuel and ammunition.

Soon after the C.M.B.s had started, four German seaplanes appeared and shadowed the Harwich Force for a time; then, just before 8.30 a.m., the Zeppelin L.53 (Kapitänleutnant Prölss) was sighted N.E. of the flotilla at a height of about 15,000ft. Admiral Tyrwhitt turned his force seawards and laid smoke screens. These manœuvres sufficed to entice the Zeppelin to follow the ships, and at 8.58 a.m., Culley took off in his Camel. His take-off run on this occasion was but five feet.

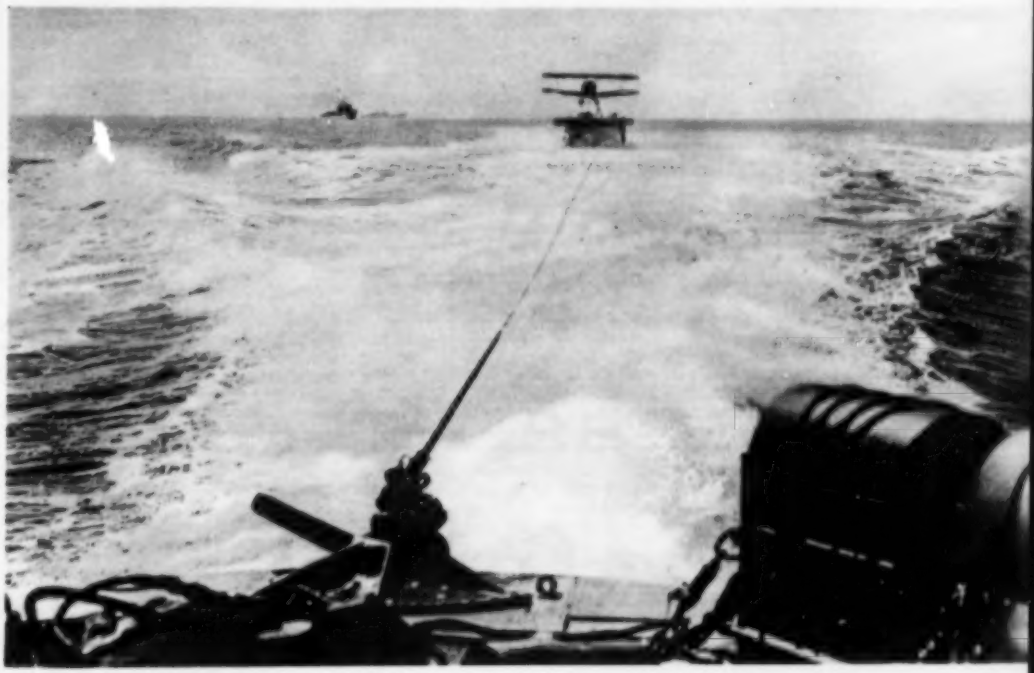
At 9.30 a.m., Culley was at 18,000ft, with the Zeppelin 1,000ft higher; and at 9.41 a.m. the two craft were approaching each other, the Camel no more than 300ft below the airship. Culley could climb no higher. He pulled back the control column and fired at the L.53. One of his guns jammed after firing only seven rounds, but the other sent a stream of bullets into the airship. Some seconds later the Zeppelin caught fire, flared up in a great burst of flame, and broke in two. It was the last German airship to be shot down during the war.

Culley had some difficulty in finding the flotilla again and had switched over to his emergency tank before he sighted the British ships. He came down on the water alongside his destroyer; when his Camel was hoisted aboard the lighter it had a pint of petrol in the tank.

Four lighter-borne Camels accompanied the Harwich Force on October 24th, when an attempt was made to attack the German seaplane stations at Borkum and Nordeney. Four flying-boats were also taken on lighters, and ten more were flown out from Yarmouth and Felixstowe. The plan miscarried: again it proved impossible for the lighter-borne flying-boats to take off, and it was found that three of the Camels could not be flown because the heavy seas coming aboard had damaged their tail-guide trestles.

The most spectacular of the exploits of carrier-borne 2F.1 Camels had taken place some three months earlier—on July 19th, 1918. It had been decided to attack the Zeppelins in their sheds, for which purpose two special flights of Camels had been formed and their pilots had been carefully trained for the operation. The Camel flights embarked in *Furious* at the end of June 1918.

The first attempt was abandoned owing to unfavourable weather on June 29th, and *Furious* and the First Light Cruiser Squadron did not leave Rosyth again until July 17th. A thunderstorm postponed the operation until the 19th. At dawn on that day the carrier was 80 miles N.W. of the German airship base at Tondern, and soon after 3 a.m. the seven Camels were airborne, each carrying two 50-lb bombs. The first Flight of three were flown by Capt. W. D. Jackson, Capt. F. W. Dickson and Lt. N. E. Williams; and the four machines of No. 2 Flight were in the hands of Capt. B. A. Smart, Capt. T. K. Thyne, Lt. S. Dawson and Lt. W. A.



Camel 2F.1 taking-off from a lighter towed behind a destroyer. Below, Camel 2F.1 slung under the airship R.23.

Undercarriage of early deck-landing Camel 2F.1, showing the clips under the spreader bar and the airscrew guard.

SOPWITH CAMEL . . .

Yeulett. (Capt. Smart, flying a Sopwith Pup from H.M.S. *Yarmouth*, had shot down the Zeppelin L.23 on August 21st, 1917—see *Flight*, January 1st, 1954, page 10.)

Only six Camels reached the objective, for one had been forced down on the water with engine trouble. The bombs of the first Flight struck one of the two airship sheds, and caused a great fire to break out. The shed was destroyed and with it the two Zeppelins it contained, L.54 and L.60. The second Flight of Camels bombed the other shed and damaged it badly, but no other airship was destroyed.

Only two of the Camels, those flown by Dickson and Smart, returned to *Furious*. Jackson, Williams and one of the other pilots lost their way and had to land in Denmark; Yeulett had to come down on the water and was drowned.

An experimentally modified 2F.1 Camel was at Felixstowe Air Station in 1918. This machine had twin Vickers guns and a special undercarriage made of steel tubes. Each vee was connected across its open end by a length of steel tube, and the structure had the appearance of being jettisonable. Lashing points under the lower wings and rear fuselage hinted at use from lighters, in which case a jettisonable undercarriage would lessen the risk of nosing over when ditching; for this was the inevitable conclusion of all flights made by the lighter-borne Camels when at sea.

From land stations such as Great Yarmouth the R.N.A.S. used Camels, probably both F.1s and 2F.1s, as fighting escorts for the patrolling Short seaplanes and for anti-submarine patrols. These duties entailed long flights over the sea, and were not accomplished without losses.

In the summer of 1918 it was decided to conduct experiments to provide our own rigid airships with adequate means of defence against enemy aeroplanes. It was intended that an airship should carry with her a single-seat fighter which could be released and flown when the need arose. The first experiments were conducted at Pulham. The airship concerned was the R.23, and the fighter was the Sopwith 2F.1 Camel.

A special horizontal surface was attached to the keel of R.23. The upper wing of the Camel fitted snugly up against this surface, which spanned the distance between the Camel's interplane struts; and the attachment between aeroplane and airship was made by a quick-release hook which passed through the central cut-out in the Camel's centre section. The aeroplane attachment fittings were made by No. 212 Squadron, R.A.F., Great Yarmouth. Camels used in these experiments were N.6622 and N.6814.

The first test was made with a Camel which had its controls locked and carried a dummy pilot. The release was accomplished satisfactorily, and a live drop was then made by Lt. R. E. Keys, D.F.C., of No. 212 Sqn. He was able to start his Camel's engine after release and flew round the airship before landing safely at Pulham. The Armistice removed the need for such devices and almost eclipsed Keys' achievement. The Germans subsequently claimed that they had dropped an aeroplane from the Zeppelin L.35 in 1917. Experiments in Britain were abandoned until the end of 1925, but thereafter were not pursued. The Americans used the device on some of their airships in later years.

The 2F.1 Camel remained in service for a time after the Armistice, and at least one continued to fly operationally. Early in 1919, H.M.S. *Vindictive* was operating in the Baltic during the campaign against the Bolsheviks, and her 2F.1 Camel carried out many patrols over Baltic waters.

The type was used on aircraft carriers in experiments with arrester gear at a time when the arrester cables were longitudinal and had a wooden ramp under their forward ends. As the aircraft ran up the ramp the friction of the cables in the undercarriage hooks increased until the machine was brought to rest. The Camel had three hooks under the spreader bar of the undercarriage, and a special guard was fitted in front of the wheels to prevent damage to the airscrew.

The F.1 Camel survived for a short time, but it had already been decided to re-equip Camel squadrons with Sopwith Snipes, which type had been adopted as the standard single-seat fighter of the post-war R.A.F. A number went to Canada and were used by the Canadian Air Force. Some were still to be seen in storage at Camp Borden, Ontario, in 1927.

There was really no place for the Camel in civil aviation. Only two went on to the British Civil Register, as G-EAWN and G-EBER. The former, owned and flown by Capt. Hubert Broad, gave aerobatic displays at seaside resorts in 1921.

There was never another aeroplane quite like the Camel. By those who survived their own early attempts to fly it, this stumpy little single-seater was usually regarded as an aeroplane without equal as a fighting machine, albeit one to be handled with respect. When thoroughly understood, the Camel became a marvel of manœuvrability, and, for a time at least, Camel pilots were regarded almost as men apart. The diarist of *War Birds* did not disguise his feelings about Camels: "I don't want to fly Camels and certainly not Clerget Camels. I told him [Elliott White Springs] I'd crown him eternally if he got me put on those little popping firecrackers."

Or, in the succinct words of Capt. Norman Macmillan: "The Camel was a fierce little beast. . ."

SERVICE USE

Western Front.—*F.1 Camel, 130 h.p. Clerget:* R.F.C. Squadrons Nos. 28, 43, 45, 54, 65, 70, 71 (Australian) (later No. 4 Sqn., A.F.C.), 73 R.N.A.S. Squadrons Nos. 6, 8 and 9. 148th Aero Squadron, U.S. Air Service. 1st, 4th, 6th and 11th Squadrons, Belgian Flying Corps.
F.1 Camel, 110 h.p. Le Rhône: R.F.C. Squadrons Nos. 3, 46, 54, 71 (Australian), 73 and 80. Night-fighter version used by R.A.F. Squadrons Nos. 151 and 152. 17th Aero Squadron, U.S. Air Service.
F.1 Camel, 150 h.p. B.R.1: R.N.A.S. Squadrons Nos. 1, 3, 4, 8, 9, 10 later renumbered as R.A.F. Squadrons 201, 203, 204, 208, 209 and 210).

Seaplane Escort.—R.N.A.S. Seaplane Defence Squadron, St. Pol, named No. 13 (Naval) Squadron in January 1918, renamed No. 213 Squadron, R.A.F., on April 1st 1918. R.N.A.S. Stations Great Yarmouth, Felixstowe, Manston.

Italy.—R.F.C. Squadrons Nos. 28, 45 and 66. Major W. G. Barker, V.C., D.S.O., M.C., retained his Camel when with No. 139 Squadron. R.N.A.S. Station Otranto. R.A.F. Squadrons Nos. 224 and 225, Otranto (6 Camels each). R.A.F. Squadron No. 226, Taranto (6 Camels).

Aegean.—R.N.A.S. Stations Thasos (later No. 222 Squadron), Imbros (No. 220 Squadron), Mitylene, and Lemnos (No. 223 Squadron).

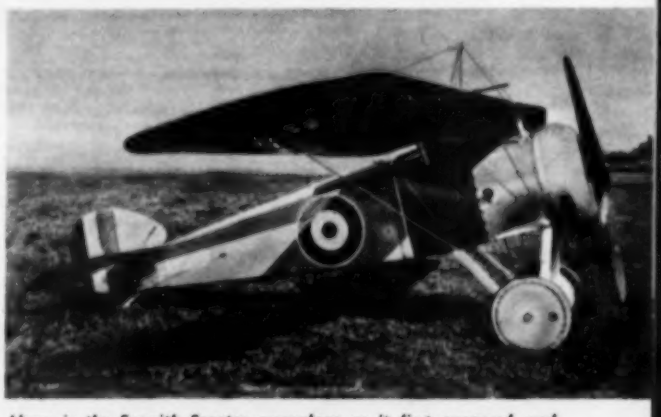
Macedonia.—No. 150 Squadron ("C" Flight). No. 221 Squadron.

Mesopotamia.—No. 72 Squadron ("A" Flight).

Russia.—R.A.F. Contingent at Archangel. Slavo-British Aviation Group. No. 221 Squadron at Petrovsk. "B" Flight of No. 47 Squadron (1919).

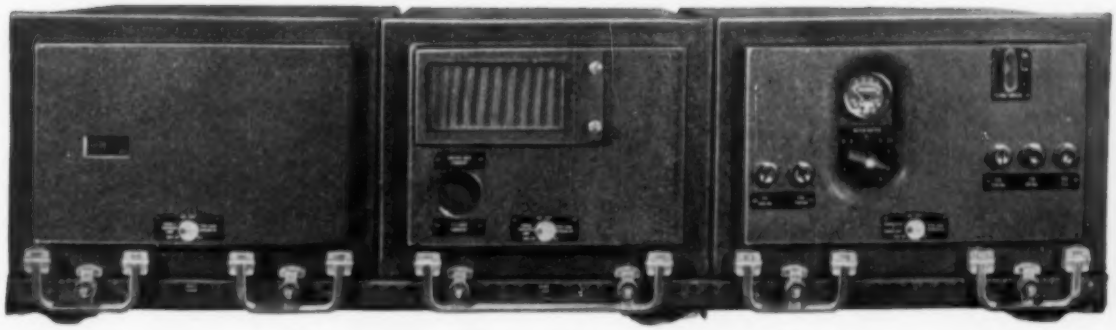
Home Defence.—R.F.C. Squadrons Nos. 37, 44, 50, 61, 78, 112, 143. R.N.A.S. Stations Great Yarmouth (No. 212 Squadron), Burgh Castle (Flight of No. 273 Squadron).

Training.—Schools of Aerial Fighting at Marske, Turnberry, Freiston and Sedgeford; Advanced Air Firing School, Lympne; No. 10 Training



Above is the Sopwith Scooter monoplane as it first appeared, and below is the Swallow, the single-seater fighter version of the same machine. These two 1918 Camel developments were mentioned in Pt. 1.

Pilot-operated radio telephony



MARCONI SELF-TUNING MULTI-CHANNEL H.F. COMMUNICATION EQUIPMENT. Type AD 307

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(left)
Drive and Receiver Unit
(centre)
Amplifier Unit
(right)
Modulator Power Unit
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SOPWITH CAMEL . . .

Squadron, Gosport; No. 31 Training Squadron, Wyton; School of Special Flying, Gosport; Eastbourne; No. 204 Training Depot Squadron, Eastchurch; 23rd Training Wing, South Carlton; Harling Road; Cranwell; Scampton; Tern Hill; Weston-on-the-Green; Minchinhampton; R.N.A.S. War School, Manston. *Night-flying training:* Squadrons Nos. 188, 189, 198. *Canada:* No. 94 Reserve Squadron.

Two-seat version known to have been used at Cranwell, Eastbourne, Scampton, Eastchurch and South Carlton.

2F.1 Camel.—Aircraft Carriers *Argus*, *Furious*, *Pegasus* and *Eagle*. Battle Cruisers *Barham*, *Repulse*, *Renown*, *Australia*, *New Zealand*, *Inflexible*, *Indomitable*, *Tiger*, *Princess Royal*, *Lion*. Large light cruisers *Glorious*, *Courageous*, *Vindictive*. Light cruisers *Caledon*, *Calliope*, *Cassandra*, *Cordelia*, *Dublin*, *Birkenhead*, *Southampton*, *Chatham*, *Galatea*, *Melbourne*, *Sydney*, *Phaeton*, *Royalist*, and *Yarmouth*.

Flown from lighters towed by destroyers of the Harwich Force. Used at some shore stations of the R.N.A.S., e.g. Great Yarmouth, Manston, Port Victoria, Cranwell, Donibristle.

CAMELS ON CHARGE OF R.A.F., OCTOBER 31st, 1918

	F.1				2F.1
	Clerget	Le Rhône & Mono.	B.R.1	Total	
Expeditionary Force, France	344	272	186	802	—
Independent Force, France	27	—	—	27	—
Italy	75	—	—	75	—
Mediterranean	100	—	—	100	6
Dover-Dunkirk Command	12	—	24	36	—
Home Defence Units ...	—	181	—	181	—
Training Units	142	3	1	146	2
Other units in U.K. ...	355	39	34	428	8
Egypt and Palestine ...	—	9	—	9	—
Macedonia	—	11	—	11	—
Mesopotamia	—	11	—	11	—
En route to Middle East ...	26	25	—	51	—
With units of the Grand Fleet	4	10	26	40	112
Aeroplane Repair Depots ...	72	14	1	87	—
In store	160	127	84	371	—
Aircraft Acceptance Parks	25	119	—	144	1
Grand totals	1,342	821	356	2,519	129

PRODUCTION AND ALLOCATION

A total of 5,490 Camels were built: 1,325 in 1917 and 4,165 in 1918. Of the 4,188 machines which were distributed to units of the R.F.C. and R.A.F., 2,116 went to squadrons with the B.E.F. in France; 24 went to the Independent Force; 145 to squadrons with the Dover - Dunkirk Command; 218 to Italy; 72 to units in the Mediterranean; 57 to the Middle East Brigade; 377 to Home Defence squadrons; and 1,179 to Training Units. The American Expeditionary Force purchased 143 Camels in June 1918.

COSTS

	£	s
Sopwith F.1 airframe, less engine, instruments and guns	874	10
130 h.p. Clerget engine	907	10
110 h.p. Le Rhône engine	771	10
100 h.p. Gnôme Monosoupape engine	696	0
150 h.p. B.R.1. engine	643	10
Sopwith 2F.1 airframe, less engine, instruments and guns	825	0

KNOWN SERIAL NUMBERS

F.1 Camel.—B. 2301 - B.2550: built by Ruston, Proctor. B.3751 - B.3950: by Sopwith. B.4601 - B.4650: by Portholme Aerodrome. B.5151 - B.5250: Boulton & Paul. B.5401 - B.5450: Hooper. B.5551 - B.5650: Ruston, Proctor. B.5651 - B.5750: Clayton & Shuttleworth. B.6201 - B.6450: Sopwith. B.7131 - B.7180: Portholme Aerodrome. B.7181 - B.7280: Clayton & Shuttleworth. B.7281 - B.7480: Ruston, Proctor. B.9131 - B.9330: Boulton & Paul.

C.1 - C.200: Nieuport & General. C.1551 - C.1600: Hooper. C.1601 - C.1700: Boulton & Paul. C.3281 - C.3380: Boulton & Paul. C.6701 - C.6800: British Caudron. C.8201 - C.8300: Ruston, Proctor. C.8301 - C.8400: March, Jones & Cribb.

D.1776 - D.1975: Ruston, Proctor. D.3326 - D.3425: Clayton & Shuttleworth. D.6401 - D.6700: Boulton & Paul. D.8101 - D.8250: Ruston, Proctor. D.9381 - D.9530: Boulton & Paul. D.9531 - D.9580: Portholme Aerodrome. D.9581 - D.9680: Clayton & Shuttleworth.

E.1401 - E.1600: Ruston, Proctor. E.4374 - E.4423: Clayton & Shuttleworth. E.5129 - E.5178: Portholme Aerodrome. E.7137 - E.7336: Ruston, Proctor.

F.1301 - F.1550: Boulton & Paul. F.1883 - F.1957: Boulton & Paul. F.1958 - F.2007: Portholme Aerodrome. F.2008 - F.2082: Ruston, Proctor. F.2083 - F.2182: Hooper. F.3096 - F.3145: Clayton & Shuttleworth. F.3196 - F.3245: Nieuport & General. F.3918 - F.3967: Nieuport & General. F.3968 - F.4067: Ruston, Proctor. Between and about F.4193 - F.4204 (probable batch F.4171 - F.4220). F.4974 - F.5073: Clayton & Shuttleworth. F.5174 - F.5248: March, Jones & Cribb. Between and about F.5939 - F.5993. F.6022, F.6024, F.6037, F.6138, F.6194, F.6211, F.6257. F.6301 - F.6500: Boulton & Paul. F.8501, F.8509, F.9579.

H.508, H.550. H.826, H.828. H.2700 (probable batch H.2646 - H.2745) H.7007. H.7272. N.518. Between and about N.6332 - N.6351 (probable batch N.6330 - N.6379).

2F.1 Camel.—N.5 (prototype). N.6600 - N.6649. Between and about N.6779 - N.6814. Between and about N.7120 - N.7136 (built by Beardmore; probable batch N.7100 - N.7149). Between and about N.7357 - N.7369 (probable batch N.7350 - N.7399). N.8151, N.8153, N.8156, N.8204.

NOTES ON INDIVIDUAL MACHINES

(Squadron Equipment, F.1 Camel)

No. 3 Sqn., R.F.C.—B.2451, B.2491, B.9267, B.9297, D.6431, D.6483, D.6519, D.6627, E.1402, F.6032.

No. 45 Sqn., R.F.C.—B.2311, B.2321 (Aircraft "S"), B.2323, B.2340, B.2375, B.2376 ("E"), B.2426, B.2430 ("B"), B.2446, B.2470, B.2476, B.2494, B.3791, B.3872, B.4609 ("F"), B.5152 (later to No. 210 Sqn.), B.5181, B.5238 (also flown at A.A.F.S., Lympne), B.6238 ("C"), B.6383 ("A"), B.6412 ("D"), B.7381.

No. 65 Sqn., R.F.C.—E.1481, E.7160, E.7189, E.7261, E.7279, F.6355, H.7007.

No. 71 Sqn., R.F.C. (later No. 4 Sqn., Australian Flying Corps)—B. 778, B.2387, B.2409, B.2420, B.2424, B.2478, B.2488, B.2489, B.2535, B.3903, B.5229, B.5625, B.5629, B.5644, B.5646, B.5647, B.5649, B.7382, B.7385, B.7390. B.7394, B.7395, B.7406, B.7412, B.7480, B.9302, C.3324, C.8261, C.8300, D.1818, D.1838, D.1846, D.1863, D.1874, D.1884, D.1893, D.1895, D.1896, D.1909, D.1920, D.1927, D.1959, D.6506, D.6512, D.6520, D.6580, D.6608, D.8116, D.8159 (flown by Capt. H. J. Watson, D.F.C.; 13 E.A.), D.9384, D.9426, D.9428, E.1407, E.1415, E.1416, E.1482 (flown by Lt. T. C. R. Baker; 12 E.A.), E.1505, E.1557, E.1592, E.7174, E.7180, E.7187, E.7190, E.7202 (flown by Capt. R. King, D.S.O., D.F.C.; 22 E.A.), E.7233, E.7238, E.7241.

No. 1 (Naval) Sqn., and No. 201 Sqn., R.A.F.—B.5749, B.6204, B.6299, B.7190 (formerly of Nos. 9 and 10 (Naval) Squadrons), C.125, C.191, C.6718, D.9667 ("Rosalind Castle," Aircraft "B" of 'A' Flight), D.9669, E.4411, F.5227 (Aircraft "F" of 'A' Flight), F.5939, F.5941 (Aircraft "E" of 'A' Flight), F.5972, F.5991, F.6022.

No. 3 (Naval) Sqn., and No. 203 Sqn., R.A.F.—B.3786, B.3855, B.5687, B.6212, B.6378, B.6408, B.7162, B.7185, B.7197, B.7198, B.7228, B.7273, B.7274, B.7275, D.3312, D.3363, D.3371, D.3376, D.3413, D.9592,

No. 204 Sqn., R.A.F.—C.71, D.9600 (formerly of No. 210 Sqn.), D.9622, F.3100, F.3929, F.6037, F.8501, F.8509 (later to No. 210 Squadron).

No. 9 (Naval) Sqn., and No. 209 Sqn., R.A.F.—B. 3818, B.3819, B.3830, B.3832, B.3880, B.3883, B.3884, B.3892, B.3893, B.3897, B.3905, B.3906, B.3907, B.3919 (later to No. 10 [Naval] Sqn.), B.3998, B.5651, B.5652, B.5653, B.5664 (formerly of No. 10 [Naval] Sqn), B.5749, B.6217, B.6230, B.6356, B.6358 (also used by No. 10 [Naval] Sqn.), B.7190 (later to Nos. 10 [Naval] and 201 Sqns.), B.7199, B.7200, B.7245, B.7247, B.7249, B.7250, B.7270, B.7272, B.7273, D.3326, D.3328, D.3332, E.4389.

No. 10 (Naval) Sqn., and No. 210 Sqn., R.A.F.—B.2490, B.3808, B.3817, B.3919 (formerly with No. 9 [Naval] Sqn.), B.3921, B.3925 ("L"), B.3940, B.5152 ("M," formerly with No. 45 Sqn.), B.5664 (later to No. 9 [Naval] Sqn.), B.5667, B.6204, B.6242, B.6299, B.6351, B.6358 (also used by No. 9 [Naval] Sqn.), B.7148, B.7153, B.7190 (formerly of No. 9 [Naval] Sqn., later to No. 201 Sqn.), B.7215, B.7221, B.7252, B.7280, C.62 (later to No. 204 T.D. Sqn., Eastchurch), D.1872, D.1883, D.3332, D.3357, D.3381, D.3382, D.3387, D.3388, D.3390, D.3392, D.3410, D.3418, D.9499, D.9548, D.9591, D.9600 (later to No. 204 Sqn.), D.9613, D.9614, D.9622, D.9675, E.4406, E.4407, F.3107, F.6257, F.8507, F.8509 (previously of No. 204 Sqn.).

No. 12 (Naval) Sqn., and No. 212 Sqn., R.A.F.—B.3882, B.3897 (formerly of No. 9 [Naval] Sqn.), B.5666, B.6369.

17th Aero Sqn., U.S.A.S.—B.9268, C.3351, C.8337, C.8397, D.3396, D.9423, F.2141, F.2146, F.2164, F.5967, F.5993, F.6024, F.6138, F.6194, F.6211, H.828, H.7272.

No. 10 Training Sqn., Gosport.—B.5215, B.7316, B.7359 ("P"), B.9232 ("V"), B.9316 ("Q"), C.9 ("P").

R.N.A.S. War School, Manston.—B.3819 (formerly of No. 9 [Naval] Sqn.), B.3846, B.3868, B.3883 (formerly of No. 9 [Naval] Sqn.), B.3898, B.5661, B.5688, B.5734, B.6203, B.6225, B.6291, B.6328, N.6610, N.6893.

No. 204 Training Depot Sqn., Eastchurch.—B.5713 (two-seater), B.6280, B.6281, C.62 (formerly of No. 10 [Naval] Sqn.), D.1812, E.1520, E.1523, E.1524, F.4193, F.4199, F.4200, F.4201, F.9579.

Details of Other Machines

B.3772: sold to U.S.A. B.3801: two-seater. B.3891: sold to France. B.5157: "F" Flight, School of Special Flying, Gosport. B.5203: No. 54 Squadron, B.5238: A.A.F.S., Lympne, B.5243: Manfred von Richthofen's 66th victory, 18.3.18. B.5584: "B" Flight, School of Special Flying, Gosport. B.5710 and B.5711: sold to Belgium. B.6313: flown by Maj. W. G. Barker, V.C., D.S.O., M.C., in Squadrons Nos. 28, 66 and 139. B.7217: Friedrichs' first victory, 18.3.18. B.7230: Scholz's fifth victory, 18.3.18. B.7239: two-seater. B.9134: "Goody" of "E" Flight, School of Special Flying, Gosport. B.9147: Kirchstein's first victory, 18.3.18. B.9229: Scholz's 4th victory, 18.3.18. B.9276: became Sopwith Swallow. B.9278: became Sopwith TF.1. C.57: two-seater used at Eastbourne. C.8234: No. 70 Squadron. D.6491: No. 46 Squadron: Richthofen's 76th victory, 6.4.18. D.8217: No. 213 Squadron, D.9400: sold to U.S.A. D.9481: Udet's 47th victory, 8.8.18. D.9638: No. 70 Squadron. F.1946: two-seater. H.826: No. 151 Squadron. H.2700: became G-EAWN. N.6603: H.M.S. *Pegasus*. N.6622 and N.6814: Experiments with H.M.A. R.23. N.6625: Cranwell, N.6779: H.M.S. *Calliope*. N.7103: H.M.S. *Barham*.

Some of the 26 aircraft which visited Ramsgate Airport early on a Sunday, for the season's first breakfast patrol (news item below).

CLUB AND GLIDING NEWS

TWENTY-SIX light aircraft from Southern and Midlands clubs descended on Ramsgate Airport on Sunday, April 17th, for the season's first breakfast patrol. The Ramsgate Flying Club defenders, although numerically small, were both active and efficient, Edward Day in his Gipsy Gemini being particularly energetic. The cloudbase was little over 600ft, and so Ramsgate conformed with modern thinking by providing an all-weather fighter of slightly heavier calibre than is usual at club events, i.e., a Rapide (which normally earns its bread and butter giving circuits to local holiday-makers).

Of the 26 attackers, only three reached their goal unobserved: pilots Franklin and Edwards in an Auster and a Magister from Elstree, and Stebbings in a Hornet Moth from Stapleford Tawney. With so limited a vertical field it was indeed a defenders' day. The meeting formed a pleasant start to the season, enhanced by the attractive clubhouse and the steady improvement towards what was the very best of group captains' weather. Leisurely return flights around the coast enabled many attackers to return home by the time most people's Sundays begin to dawn.

UNLESS a further eighteen members can be enrolled in the immediate future, the dissolution of the Southport Aero Club, not yet operational, appears imminent. To acquire an aeroplane, a loan from the Kemsley Flying Trust was sought by the club; the trustees first required that (a) arrangements be made with Southport Corporation for the use of Hesketh Park Aerodrome and (b) sufficient members be enrolled at the outset to ensure full utilization of the aircraft.

Permission has since been obtained for the club to operate from Hesketh Park, but at present only 22 out of the required 40 members have joined. Further support from flying enthusiasts in the Southport area is thus urgently needed for the club's existence to continue. Those interested should apply for membership to the secretary, Southport Aero Club, 70 Princes Street, Southport, as soon as possible: it is emphasized that all fees will be repaid in full if the club fails to become operational. Estimated flying rates are approximately 35s per hour.

FLYING hours at the Fair Oaks Aero Club totalled 148½ during March, when a first solo was made by Mr. D. M. Jones and a P.P.L. obtained by Mr. Bish. Club-members Cavill, Doyle and Lovegrove have obtained instructors' certificates and commenced part-time instructing duties; in addition, Don Doyle has obtained his Commercial Pilot's Licence. A marked increase in flying activity has taken place since the first of this month, when the Vickers-Armstrongs works flying club commenced operation. With 60 members, the Vickers group helped to push up the Fair Oaks flying time to over 350 hours within the first three weeks.

A NEW permanent gliding site at Nympsfield, on the Cotswolds, has been purchased by the Bristol Gliding Club, with assistance from the Kemsley Flying Trust. The future of the club, which has been operating on a rather insecure basis since 1946 at Lulsgate Bottom Aerodrome, is now assured, and it is planned to develop the site into a gliding centre for the West of England. Incidentally, only one other gliding club in England owns its site—the London Gliding Club, which purchased land on Dunstable Downs in 1931.

Establishment of the new site at Nympsfield—well situated for both ridge and thermal soaring—is expected to cost several thousand pounds, all of which will have to be earned by the club eventually. To keep costs down, working parties of members will visit Nympsfield during this summer to help in constructing the club house and hangar. The land itself is being sown with grass and allowed to consolidate, and full-scale operations by the club are expected to start by Easter, 1956. Until then, normal club activities (including holiday courses for non-members) will be continued at Lulsgate, which is eventually to become the new Bristol Airport.

CENTRAL African flying clubs participated in the annual Federal Air Race and Rally held at Lusaka, Northern Rhodesia, over the Easter weekend, when the "Herald" Trophy was won by Mr. W. Kleyn, of the Gatooma Flying Club, in a Tiger Moth. Second and third places in the three-lap, 58-mile race went also to Tiger Moth pilots—Mr. F. Wingrove and Mr. McKone (both of the Marlborough Flying Club) respectively. After the race, a display of Vampire aerobatics was given by pilots of the Royal Rhodesian Air Force, and a spot-landing competition was won by Mr. J. A. Thomas of the Lusaka Flying Club, flying an Aeronca. Mr. Thomas, who had only 20 hours' flying experience, was also awarded a tankard by the Association of Central African Flying Clubs for the day's best performance by a pilot with under 200 hours. A balloon-bursting contest was won by Mr. A. J. H. Roberts, secretary of the association. The rally was organized by the Lusaka Flying Club, the prizes being presented at a ball on the Saturday evening at the Ridgeway Hotel, Lusaka.

PILOTS of non-radio aircraft flying to the Channel Islands International Air Rally on May 7-9th are reminded that they should contact Jersey A.T.C. by telephone before take-off for clearance and any necessary final briefing. This clearance may be requested from A.T.C. at the Customs Airport of departure by tie-line to Jersey *via* Uxbridge. Radio-equipped aircraft should contact "Jersey Zone" on 120.3 Mc/s or any other common frequency before entering the Channel Island Control Zone, and aircraft without radio must fly in V.F.R. conditions.

OUTSTANDING French soaring flights made during this month include a new world women's goal-flight record of 373 km (232 miles), set up by Francine Abadie and Jacqueline Trubert in a Castel 25S sailplane on April 16th. They flew from La Ferte Alais to Cognac. In addition to beating the French national women's two-seater record for a goal flight, Abadie and Trubert's flight gained also the national women's two-seater record for distance in a straight line.

The French free-distance record was broken on April 17th, when Kirschroth and Lerat flew 438 km from Persan Beaumont to Muron in a Castel Maboussin CM.1. Also on the 17th, the previous day's national women's distance record was broken by Choisnet and Abelanda with a 440-km flight from Beynes to St. Georges des Agouts, also made in a Castel 25S.

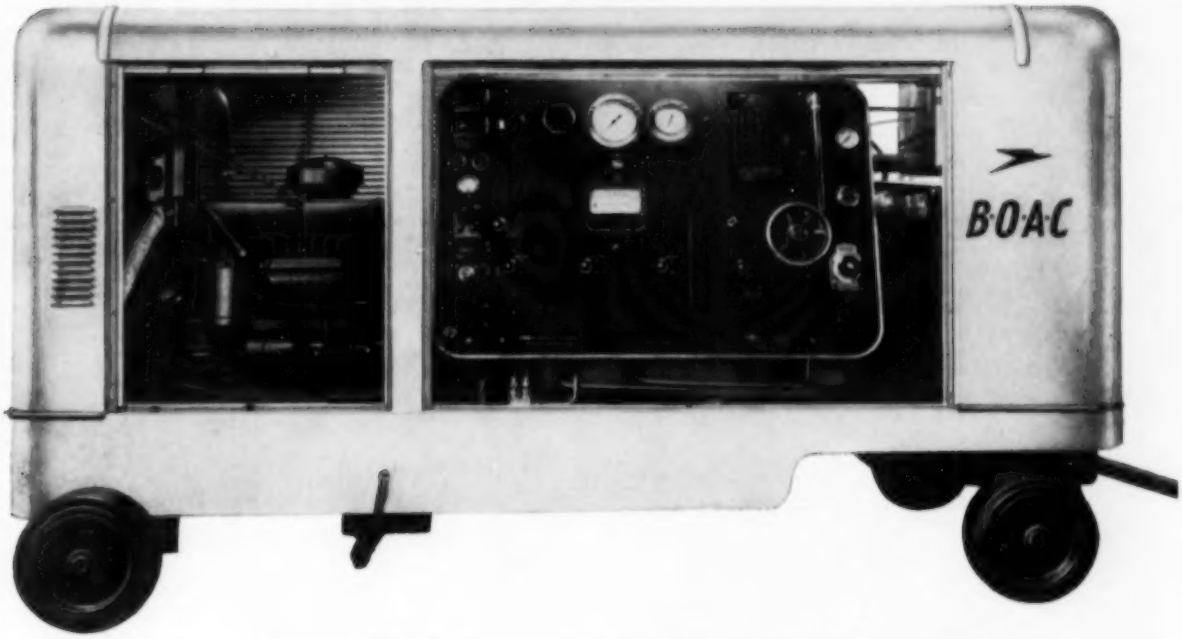
Among other excellent flights during the month was one by Gabriel Margerit on April 14th in a Bréguet 901, in which an absolute altitude of 9,100 metres (29,800ft) was achieved. Although greater than Rousselet's French national record of 8,931 metres, this height does not exceed it by the 5 per cent margin required for a new record. Mentioned briefly in *Flight* last week, René Branciart's flight on the same day to 5,900 metres in a Bréguet 900 was in fact the first occasion on which Mont Blanc had been flown over by a sailplane.

FORTHCOMING EVENTS

Apr.	30.	R.Ae.C.: First National Air Races meeting, Fairwood Common, Swansea.
Apr.	30.	Institute of Welding: "Oxy-acetylene Pressure Welding of Aircraft Undercarriage Components," by J. J. Wilson and D. C. Brown.
May	2-13.	British Industries Fair: Olympia, London, and Castle Bromwich, Birmingham.
May	3.	R.Ae.S. Section lecture: "Plastic Structures," by G. C. Hulbert, B.Sc.
May	4.	Royal Society of Arts: Trueman Wood Lecture: "New Ways of Flying," by Maj. O. Stewart, M.C., A.F.C.
May	4.	R.Ae.S. Graduates and Students Section: "Technical Aspects of Supersonic Aircraft Design," by E. J. Catchpole, M.S. in Ae., B.Sc. (Eng.), M.I.A.S., Grad. R.Ae.S., and W. J. Egginton, B.Sc., Grad. R.Ae.S.
May	7-9.	Channel Islands Aero Club: International rally.
May	12.	Women's Engineering Society: "Heavy Civil Engineering Works," by C. K. Haswell, B.Sc. (Eng.), M.I.C.E.
May	14.	British Interplanetary Society: Short paper evening.
May	19.	R.Ae.S.: The 43rd Wilbur Wright Memorial Lecture: "Flight Control," by Dr. C. S. Draper, F.I.A.S.

R.Ae.S. Branch Fixtures (to May 23):

May 4, Luton, "Rubbers in Aircraft"; Weybridge, Annual General meeting. May 9, Halton, "The History of Parachuting and Ejector Seats," by R. D. Trender. May 11, Chester, Annual general meeting. May 12, Glasgow, "Aviation Fuels," by C. F. Holloway. May 16, Halton, Film Show. May 18, Hatfield, Annual general meeting. May 23, Halton, "Dynamic Heating (the Heat Barrier)," by S/L. P. C. Cleaver.



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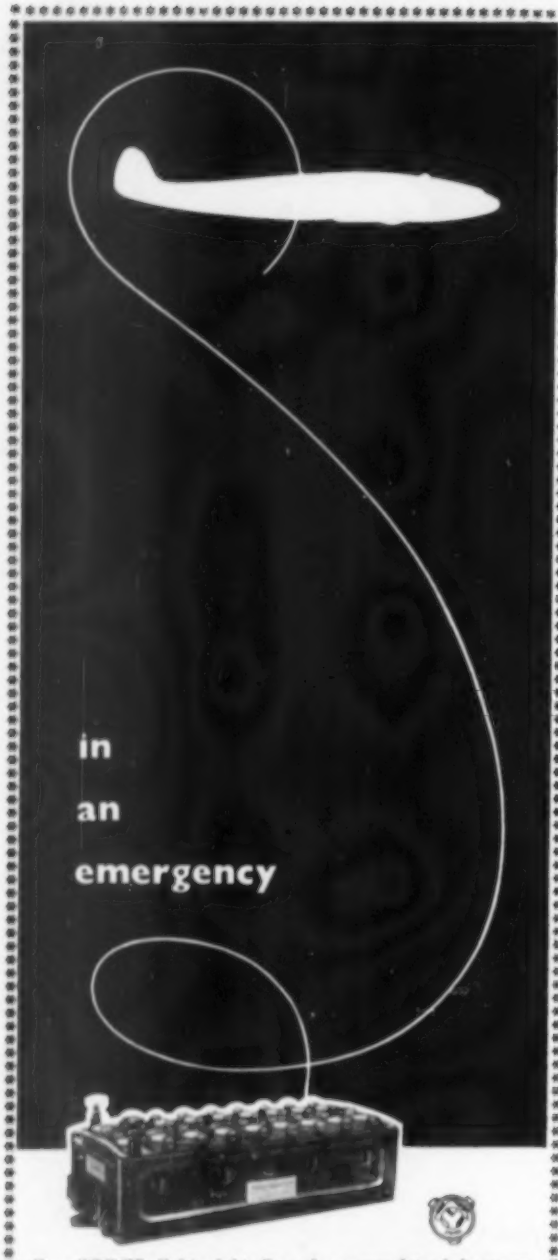

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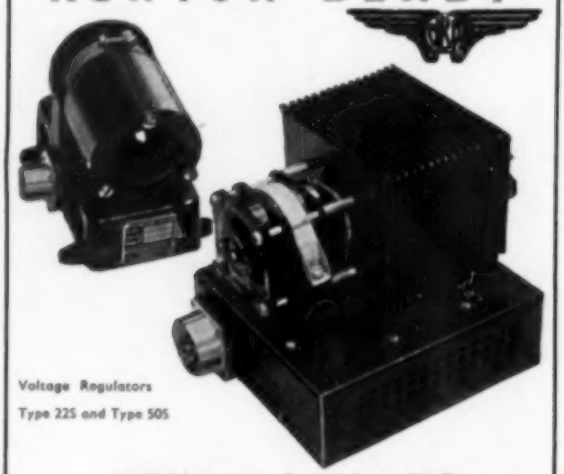

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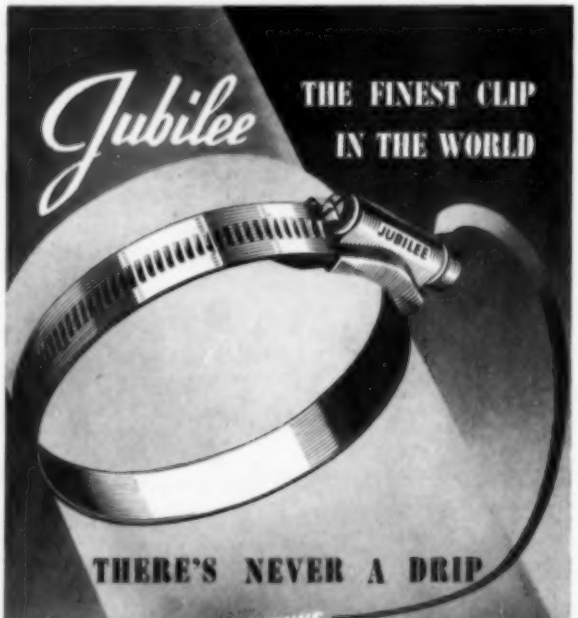

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TOWER OF LONDON

Radar, Radio, and Lighting Controls in the New Central Building

The new control block is dominated by the 127ft nine-storey tower—first section of the building to be completed. The flanking buildings are designed to house telecommunications, restaurants, administrative offices and a medical station. "Flight" photograph

THE new control tower at London Airport came into operation on the evening of April 17th, together with much new equipment designed for efficient maintenance of aircraft safety, both in the air and on the ground, and of regularity of operation. Movements into and out of London Airport are co-ordinated between the Airport Control and the nearby Southern Air Traffic Control Centre.

Departure details are passed from the clearance office by telephone to S.A.T.C.C. and by pneumatic tube or telephone to the ground controller in Aerodrome Control. When the pilot calls the tower by R/T. for taxying clearance, he is given a take-off runway and the route by which he will reach it. While following the prescribed route, the aircraft may, if necessary, be watched by the airfield surface-movement indicator, a Decca Q-band radar whose aerial is mounted on top of the control tower. This Decca equipment has been designed specifically to provide sufficient definition on a P.P.I. tube for surveillance of vehicles and aircraft moving on the ground over an area of a few miles' radius. Use of the 10 cm and 3 cm wave band could not economically provide such surveillance and Decca have ventured into the 8 mm (34,000 Mc/s) band. A target is scanned by a rotating beam one-third of a degree wide with a pulse of one-twentieth of a microsecond. The display is on a 12in-diameter fluoride cathode-ray tube giving long afterglow. During daylight it is normally viewed through a cowl. In addition to normal display controls, fast time-constant, anti-clutter, and line/logarithmic I.F. switching facilities are fitted. Six ranges are available, and the Deccaplot radar plotter can be applied to the screen to allow accurate plotting without parallax error. Several display units can be operated from one radar. The aerial head rotates at 20-24 r.p.m. and the power supply required is 80v 1,000 c.p.s.

London Airport is the first in the world to have a permanent Q-band installation for surface traffic surveillance. Two displays are used, one by the ground movements control officer and the lighting and route control officer, and the other by the air controller for watching take-offs; a third could be provided at the G.C.A. talk-down desk for watching landing runs.

While the departing aircraft is on its way to the runway the route clearance is passed to the tower by S.A.T.C.C. When it reaches the holding-point on the runway in use, control is transferred to the air controller, who passes the airways clearance to the pilot and gives permission for take-off. The air controller's desk is so designed that he can face east or west and watch aircraft taking off and landing on either of the main east/west runway directions. When the aircraft takes off the time is telephoned to the clearance office, entered on the flight plan and sent by teleprinter to the A.T.C. authorities concerned with the flight. The sequencing of the take-offs and landings is the responsibility of the controllers in the tower, and in I.F.R. or near-I.F.R. conditions their principal equipment is the Cossor A.C.R. Mk VI. This radar is, of course, in operation at Zürich-Kloten Airport in Switzerland where its performance is well-suited to the permanent-echo characteristics of the area. At London Airport it is giving particularly good service.

The A.C.R. Mk VI has four principal components, the scanner, the radar head, the equipment-room apparatus and the display console. The scanner has a 14ft-diameter paraboloidal plastic reflector and multiple-horn feed rotating 10-15 r.p.m.. Mica windows over the horns are electrically de-iced. The set operates on 2,960-2,980 Mc/s with a peak power of 450 kW. The maximum range is 60 nautical miles with intermediate settings available for 10, 20 and 40 n.m. Moving target indication, by which all stationary echoes are eliminated, can be selected either over the whole tube or from any desired range outwards. It is also possible to superimpose a system of video mapping whereby any desired diagram map can be introduced on the display in proper relationship to the range setting. This is particularly important when M.T.I. is in use. The centre of the display on the tube can be offset up to a maximum of one radius, and the video map will automatically be displaced with it. For rapid identification of aircraft "blips," signals from the Marconi A.D.210 automatic D/F. equipment can be introduced on the tube-face.

The A.C.R. Mk VI is suitable for any climate and all electronic circuits are externally sealed. A built-in air-circulation system continuously cools and dries the internal air and an automatic alarm indicates overheating or fire. In the latter case, the power supply is switched off and fire extinguishers operated. Monitoring facilities enable the functioning of the equipment to be checked continuously. The radar head, which must be within 30ft of the scanner, need not be manned once the equipment is set up. The M.T.I. circuits can be inspected without interrupting radar coverage.

The usefulness of the Cossor A.C.R. Mk VI can be seen in relation to the departure and arrival control procedures in the

Air controllers at work in the penthouse on top of the tower. Their equipment includes the Decca Q-band display (foreground) and Cossor A.C.R. Mk VI repeater (background). "Flight" photograph

TOWER OF LONDON . . .

London Airport area. Without it, for instance, separation between two aircraft on the same track or altitude is usually ten minutes; with radar coverage this can be reduced to two minutes. The air controller in Aerodrome Control has an A.C.R. Mk VI display, with the aid of which he can control aircraft after departure.

The arrival procedure is necessarily somewhat more complex. Until recently, all aircraft "stacked" over the Epsom range station and were conducted thence to touch-down under radar surveillance. By this means 15-20 landings per hour could be achieved. But at peak periods arrivals are liable to be more frequent and the "twin-stack feed" method was introduced and will probably lead initially to a frequency of 25 to 30 arrivals per hour. With the new method, aircraft stack over both the Epsom and Watford ranges and can be led in alternately with less delay. Feeding from both stacks poses a nice problem in approach control, since the sequence must be accurately timed to avoid overcrowding or unnecessary intervals. No computor has yet proved satisfactory for phasing-in approaches; it is up to the radar controller. The twin stack is at the moment used only in conjunction with the east/west runways, which are therefore kept in use in any wind-direction until cross-winds are no longer acceptable to pilots.

On the final approach, a G.C.A. talk-down takes three minutes (twenty talk-downs per hour). Aircraft are therefore encouraged to use the Pye I.L.S., which allows closer spacing; but, to avoid the increased number of overshoots which are then likely, such an approach is monitored by G.C.A. The required approach rate can thus be achieved. The G.C.A. is at present located in a caravan alongside the runway in use, but it is intended that later the G.C.A. operator should have his apparatus alongside that of the approach controllers in the tower.

After touch-down an aircraft may take over a minute to clear the runway and, when landing-frequency reaches one in two minutes the problem of clearing the runway may arise. Such devices as high-speed turn-offs may have to be introduced.

Automatic direction finding at London Airport is through Marconi type A.D.210, four-channel A.D.F. It works in the 100-156 Mc/s band and all four channels can be used simultaneously with four display units, each with its own repeater. Any channel can be selected at the display and the repeater may be up to 500ft from the main indicator. The bearing datum can be adjusted and true or magnetic reciprocal bearings, with lamp indication, selected. It is from the A.D.210 that the A.C.R. Mk VI derives its bearing signals.

All this equipment is obviously ineffective without R/T. communication, but the requirements for the new tower were such that M.T.C.A. designed its own radio communications system. This covers not only air-to-ground R/T. but communication with a large number of men and vehicles on the airfield itself. For the latter purpose Pye and Marconi have supplied the radio equipment. For air-to-ground communication the transmitters are by Burndept and the receivers are of modified Air Ministry pattern. These sets also deal with ground-to-ground control channels.

A large number of channels and stations are required and all services are duplicated so that after any failure a standby service is always available within one minute. One channel on the H.F./R.T. band is available in the tower on request and, in conjunction with older equipment, a Plessey receiver is used.

London Airport as seen through the Decca Q-band airfield surface movement indicator at its short-range setting.

The main airfield lighting services, which are directed from the ninth-storey "penthouse" (aerodrome control room), comprise the following: location and identification beacons; approach lighting; runway and threshold lighting; and taxiway lighting. The location beacon, situated 2½ miles E.N.E. of the airport, produces white and green flashes visible from up to 30 miles. Of lesser intensity, the identification beacon is situated within the airport boundary; it flashes the letters VA in Morse.

Approach lights, of Calvert cross-bar pattern, lead into both ends of the two east-west runways—i.e., on headings 10R, 10L, 28R and 28L. The runways are delineated by lights of three colours—green at the threshold, yellow along the edges of the first 2,000ft of each runway (to denote a caution zone) and white along the remaining portions of the edges. Taxiways have green centre-line lights, as now approved by I.C.A.O. (London is the first airport to apply the system), in place of the familiar blue edge lights. Since the centre-line is always at least 50ft from the edge of the track, pilots can follow it confidently without seeing the edge. The airport's entire taxying area, including runways, is divided into about 100 numbered traffic "blocks," separated by red "stop-bar" lights. When a through route is in use, as shown by illumination of a continuous line of green lights, the stop-bars are automatically extinguished. On a bright day, when the green and red lights are invisible, the correct route at a junction is indicated by a white light on the appropriate part of a diagram-type signboard.

Remote control of all the lights mentioned is effected from an arc of desks in the penthouse. The system of control, supplied and installed by Standard Telephones and Cables, enables the pattern (and, in some cases, the intensity) of lighting to be changed quickly and frequently to meet the requirements of air and ground traffic. Indication of the services controlled is provided by an "airfield lighting mimic" (which reproduces in miniature all the approach, runway and taxi lighting in use at any time). The mimic is situated on the right of the ground controller's desk, which has on its left a radar map of surface movements (the Decca equipment referred to above).

In addition to these tower-controlled services, new lighting equipment for the central area includes taxiway and overhead lighting for the apron and Class A street lighting for access roads and car parks; all three items were supplied by the General Electric Co. The 1,000 W apron floodlights are of lightweight type, weighing only 25 lb each, and are mounted on 60ft steel towers overlooking the "airside" of the passenger terminal and the uncompleted eastern apex building. Remote controls for the apron lighting are located in the "face supervisor's office" on the second floor of the passenger building. This office is provided with a "mimic" diagram of the apron area showing the position and state of parking stands (an amber light changes to red when a stand is occupied).

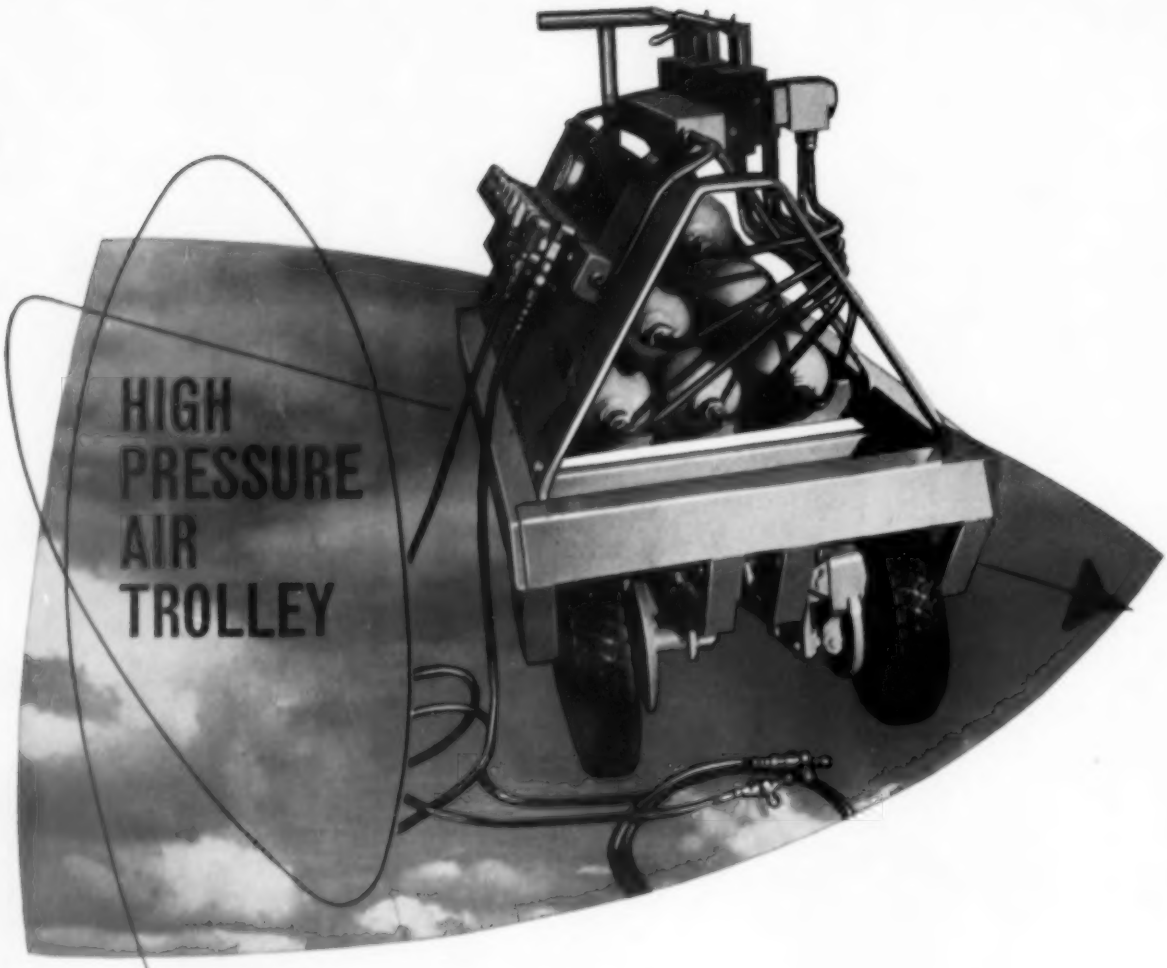
The ground controller at his desk in the penthouse. At right is the airfield lighting mimic; a second A.S.M.I. scope is on the left.

TRANS-AUSTRALIA AIRLINES

TAA

Propellers and Equipment

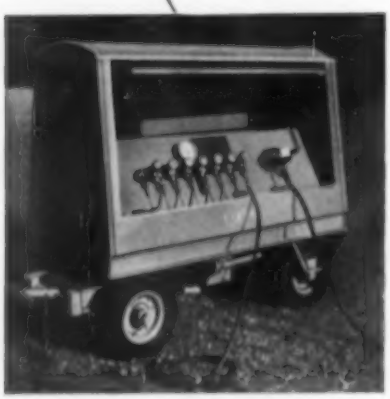
ON THE VISCOUNT TRANS-AUSTRALIA AIRLINES



The trolley incorporates six air cylinders which when charged to a pressure of 3,300 lb./sq. in. gauge contains 36 lb. weight of air.

Provision is made for charging or discharging the bottles in pairs, enabling any pair to be used separately or in combination. A charging point is provided.

All the equipment is mounted on a steel chassis, fitted with pneumatic tyred wheels, parking brake and telescopic draw bar. A metal canopy, with a sliding side panel giving access to the control valves, enables the trolley to be used out of doors under most weather conditions.



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CIVIL AVIATION

AN AUSTRALIAN ACHIEVEMENT

IN a statement outlining the Viscount's progress in service with Trans-Australia Airlines, Vickers-Armstrongs report that the 50,000th Australian Viscount passenger was carried on April 10th. "This," say Vickers, "is a remarkable achievement when it is recalled that T.A.A. started Viscount services as recently as December 18th last and had only two aircraft in use until January 1st, when a third Viscount was scheduled. A fourth aircraft came into service on February 1st."

An average fleet of 3½ T.A.A. Viscounts thus carried 50,000 passengers in 113 days. Their load passenger factor has averaged 85.2 per cent, and daily utilization has averaged 7.8 hr per aircraft; individual aircraft have, on occasions, logged 11 hr in a day. Between March 17th and March 30th all the four Viscounts in use were fully serviceable each day.

The strength of T.A.A.'s Viscount fleet was recently increased from four aircraft to five, and a sixth will follow later this year. Routes operated include Sydney - Brisbane, Sydney - Melbourne and Melbourne - Adelaide - Perth.

Vickers calculate that the total distance now flown daily by Viscounts in Europe, Australia and Canada is equivalent to more than twice round the world.

RINGWAY AGREEMENT CONCLUDED

TO mark the conclusion of protracted negotiations between Manchester Corporation and the Ministry of Transport and Civil Aviation, a luncheon was held at Manchester Town Hall on Friday, April 22nd. An agreement between the two parties provides that Manchester will continue to own and operate Ringway Airport, but that the M.T.C.A. will provide technical services and contribute to future development costs.

It was planned that the appropriate documents would be handed over to Councillor L. W. Biggs, chairman of the airport committee, but the Minister, the Rt. Hon. J. A. Boyd-Carpenter, was prevented at the last moment from attending. He had arranged, however, to produce the documents on Saturday at Ringway Airport at noon; meanwhile he was represented by Mr. G. I. Morris, his under-secretary for ground services.

All this was explained at the luncheon by the Lord Mayor, Ald. J. S. Harper, who called upon Councillor Biggs to propose the main toast, "The Ministry of Transport and Civil Aviation."

In the proposal, Mr. Biggs pointed out that the fusion of interests of Municipality and State in the future development of Ringway Airport provided a possible pattern for other airports. Manchester, as the first city with a licensed airport, had been loath to part with its interests and the present arrangement in which finance and development were to be shared was the result of long but co-operative dealings with the Ministry. Further developments would be an extension (from 5,900 to 7,000ft) of the main runway, and terminal buildings of the most modern kind; three-quarters of the development cost would be borne by the Government. The approximate cost of Government "effects," including hangars, handed over to Manchester is quoted as £250,000.

LOGGING TIME WITH Q.E.A.

SOME impressive utilization figures with their Super Constellations have been reported by Qantas Empire Airways. It is stated that an average of 10 hours' revenue flying daily was achieved on the company's trans-Pacific route during the peak period of 1954, only a few weeks after the aircraft had entered service. Carrying payloads of 15-20,000 lb, the L.1049s have on most occasions been over-flying Canton Island, thus covering the 3,190 miles between Honolulu and Fiji in a single hop. Delivery of the Qantas Super Constellations began in May 1954 and the fleet now totals ten. By the first week in February 1955 they had made 151 trans-Pacific crossings and 45 flights between Sydney and London, carrying 12,250 passengers and flying 6,850 hours. Average daily utilization of the fleet over the whole route system is 8 to 8½ hours.

ATLANTIC AIR-DROP

DAKOTA G-AMSU, operated by Dan-Air Services, Ltd., recently took the leading part in what is believed to be the first operation of its kind—an emergency air-drop of spare parts to a ship in the Atlantic. The spares—pistons and rings of 11in diameter—were required by the S.S. *Capetan Ilias*, disabled and drifting some 200 n.m. W.S.W. of Fastnet.

Commanded by Capt. Watson, the Dakota left Blackbushe Airport in the early hours of April 13th for Shannon, where it was refuelled. The met. office at Shannon reported poor visibility and low cloud in the area of the ship, and take-off from Shannon was therefore delayed until contact with the ship could be made through Valencia marine radio station, and a weather actual obtained.

The aircraft left Shannon at 0930 hr and made immediate visual contact with the ship some two hours later. As the aircraft approached and Capt. Watson circled the ship to make positive identification, a dinghy was seen pulling away to a position some 100 yd from the ship. After one dummy run Capt. Watson flew at reduced airspeed past the dinghy with wheels and flaps lowered, and dropped the package at low level some 50 yd from the dinghy. Consisting of a sealed drum containing the spare parts, with an outer protective padding of cork, the package was pushed out by a crew member through the passenger entrance, the door of which had been removed before take-off. As the aircraft left the area the master of the ship signalled that the spares were safely on board and undamaged.

The brokers responsible for arranging the charter were E. A. Gibson and Co., Ltd., of London.

PAKISTAN MERGER

THE amalgamation of Pakistan International Airlines with Orient Airlines to form the Pakistan International Airlines Corporation became effective on April 1st, 1955. The Pakistan Government has a controlling interest in the new corporation, whose principal officials are Mr. Mirza Ahmad Ispahani, chairman of the board of directors and Mr. F. M. McGregor, general manager. Henceforth all services, domestic and international, will be operated under the banner of P.I.A.

BUSHMASTER, ALIAS TRIMOTOR

A 1955 version of the Ford Trimotor, first certificated in 1926, is soon to take the air. A Californian company, Hayden Aircraft Corp., have slightly redesigned the old aircraft and plan to build it with the simplest possible factory tooling, and to fit it only with such equipment as will be required for V.F.R. flight in undeveloped regions.

Some alterations have been made to the original design, particularly in cockpit layout. Flaps have been added and the fuselage has been widened by 18in, the floor strengthened, control cables re-routed and slight improvements made to the vertical tail surfaces. It is also intended to fit lighter and more powerful engines than the original Trimotor carried, and to house these in cowlings giving better temperature control. It is reported that the new engines may be Pratt and Whitney R-985s.

Some of the estimated figures for the new aircraft, which will be called the Stout Bushmaster, are: all-up weight 12,500 lb, payload 5,000 lb, and range 525 m. The cruising speed is to be 125 m.p.h. and the stalling speed a mere 40 m.p.h. Some 30 of the original Trimotors are still flying in America.

RECRUITMENT OF AIRLINE PILOTS

IN the April issue of its journal *The Log*, the British Air Line Pilots Association comments critically on the recent findings of the joint Air Ministry/M.T.C.A. committee appointed to investigate the supply of pilots for civil aviation. It may be recalled (*Flight*, March 11th, page 293) that the committee's main conclusions were: (1) the R.A.F. would continue to provide an adequate field of civil-aviation recruitment for pilots for "at least the next seven or eight years," (2) "the age-spread, experience and technical background" of ex-R.A.F. pilots should be acceptable to civil aviation, (3) the setting-up of an independent civil-aviation flying training scheme supported from public funds was therefore not justified, and (4) the whole question of future recruitment should be reviewed after four years.

These conclusions were referred to by Mr. Profumo, Parliamentary Secretary to the M.T.C.A., in the course of a Commons debate on February 25th, when the House discussed the scheme, suggested by the Air League, for the training of commercial pilots.

B.A.L.P.A.'s criticisms, with which *Flight* is largely in agreement, include the following:—

"The main conclusion that the R.A.F. could continue to provide for a field of recruitment adequate to meet the needs of civil aviation was based largely on a canvass of some 500 R.A.F. pilots due to leave the service within a period of two years from the date of the announcement. Mr. Profumo, however, had to make an important reservation in respect of the conclusion, which reservation is typical of what has happened previously in relation to this subject. Briefly, it was that, due to the change in R.A.F. policy announced within a day or two of the debate, the Ministry was not certain how far the main conclusion was a correct one.

"This illustrates the point that this Association has made on practically every occasion it has raised the subject in the past, namely, that it is impossible for civil operators to plan ahead on the basis of Air Ministry policy and prognostications. . . . The report may well be rendered valueless by that change in policy and there is no guarantee that any future report presented in the same way may not suffer the same fate.

"We are not impressed by the composition of the committee set up by

M. Louis Lesieux, the new director-general of Air France, whose appointment is recorded below.

CIVIL AVIATION...

the Minister to examine the matter. However distinguished its membership, without having in its body any representatives from the operators it was very largely divorced from reality, for only the operators could tell them of the number of applications they had received from ex- or serving R.A.F. pilots, how many had been interviewed, how many rejected, how many accepted and the general quality of those accepted. The committee might have had a shock if it had had the information which was available to the committee of the operators and other interested parties which produced the report so utterly rejected by the Ministry. One is really amazed that the Ministry could apparently so lightly reject the recommendations made by so representative and so distinguished a body as those who contributed to that report. One might excuse the rejection of the recommendations, but one has difficulty in excusing the apparent non-acceptance of the conclusions on which those recommendations were based. One hopes that the Ministry will now discuss the report of the inter-departmental committee with those who produced the report incorporating the training scheme. It may be possible for the one body to convince the other that there is something wrong somewhere with the other's conclusions.

"But to our mind the most serious omission in the conclusions reached by the Ministry is the failure again to recognize that the pilotage of civil aircraft represents a career. . . ."

TESTING OF PRESSURE CABINS

NEW guidance on the testing of pressure cabins has been issued by the Air Registration Board in the light of recent knowledge. The Board's advice takes the form of *Civil Aircraft Inspection Procedures Leaflet AL/6-1 (Issue 2)*, dated March 15th, 1955. The introduction to the leaflet notes that tests which involve loading a cabin to pressures exceeding the safety valve blow-off pressure should not be made without the prior approval of the Board. After requirements or modifications which affect the strength of the pressure cabin, it adds, the A.R.B. must be consulted on the best procedure to be adopted.

The leaflet points out that any defect which may cause sudden loss of pressure may have serious effects, and that the pressurized part of the fuselage structure and all installations which form part of the pressure-control system must, therefore, be checked for reliability. Doors, clear-vision windows, emergency exits and the like should be free to operate and, after closing, should be checked for security; if unusual force was necessary to close any of these items the cause should be investigated. Attention is drawn to the need for, and ways of, checking skin joints and seams, sandwich windows, ducting seals, glands and joints. The leaflet also outlines methods to be adopted in conducting functioning tests of pressure control systems and leak-rate tests of pressure cabins.

In issuing the leaflet the A.R.B. states that "the proof test originally recommended is of doubtful value and the higher pressures involved may possibly be deleterious to the structure subsequently. In the circumstances the particular test is no longer recommended and has been deleted."

BREVITIES

UNTIL recently director-general of the Aeroport de Paris (the organization which controls both Orly and Le Bourget), M. Louis Lesieux has been appointed director-general of Air France. He succeeds M. René Briand, who is retiring from the airline but will continue to act as an adviser, with the title of honorary director-general. M. Lesieux will work directly under M. Max Hymans, president of Air France.

* * *

American Airlines have increased an order, first announced in 1954, for additional Douglas transports to be delivered in 1956-57. Earlier, the company had planned to increase its all-freight fleet by the addition of seven DC-6As; the new order calls for the delivery of 14 DC-7s and four DC-6As. When all the aircraft on order have been delivered American Airlines will have a total fleet of 205 aircraft made up as follows: 39 DC-7s, 50 DC-6s, 25 DC-6Bs, seven DC-6As, 75 Convairs and nine DC-4 freighters.

Radar equipment ordered for the new Southern Air Traffic Control Centre includes two long-range heightfinders of latest Marconi S.13 pattern. The aerial for this radar can be mounted on a gantry or, as illustrated, on the small building which houses the transmitter, modulator and receiver.

Height-finding radar equipment depicted on April 1st was captioned as of Marconi S.13 type. The radar shown was, in fact, older equipment (though still in use at S.A.T.C.C.) and not of Marconi manufacture; the S.13 is illustrated below.

* * *

The second of eight Super Constellations ordered by Lufthansa for transatlantic services arrived at Hamburg on April 21st, carrying a crew of twelve. Its operators had hoped to cover the 5,700 miles from Burbank, California, to Hamburg in a single hop, but winds were not favourable and the aircraft had to make a refuelling stop in Iceland.

* * *

Non-stop services between New York and San Francisco, operated by DC-7s, will be inaugurated by United Air Lines on May 6th. East-bound services will take 8¼hr to cover the 3,000-mile route.

* * *

Mr. Douglas D. Laurie has succeeded Mr. R. G. ("Ben") Cochrane as United Kingdom manager for Trans-Australia Airlines. Mr. Laurie's appointment covers both commercial and technical interests of T.A.A. in this country, the airline's resident technical representative, Mr. Frank Austin, having returned to Australia early this month.

* * *

Flown by Capt. R. Donovan, an Australian pilot formerly with K.L.M., a Super Constellation of Pakistan International Airlines set up an unofficial record on April 16th by completing the 3,800-mile route from London to Karachi in 13½hr flying time. Scheduled time for the flight is 15hr 50min.

* * *

Lord Douglas of Kirtleside, chairman of B.E.A., left London Airport on April 15th for a visit to America, where he is studying Sikorsky and Piasecki progress with multi-engined helicopters. He was later expected to attend the I.A.T.A. technical conference at Puerto Rico. Before departure, Lord Douglas said that there was no question at this stage of B.E.A.'s placing firm orders with any of the American companies.

* * *

New York will be the venue for the 11th annual meeting of the International Air Transport Association. Senior executives of the 72 member airlines will hold their discussions in the Waldorf-Astoria Hotel from October 17-21st inclusive. At the opening session, Mr. Juan Trippe, president of P.A.W.A., will take office as president of I.A.T.A. in succession to M. Hymans, president of Air France. Some 120 representatives of the I.A.T.A. airlines are taking part in the Association's 8th technical conference, which began at Puerto Rico on April 25th and is expected to continue until May 7th.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns, the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Wapitis and Whirlwinds

I WAS very interested in your article in *Flight* dated April 15th, 1955, on the history of the Westland company, particularly with regard to data concerning the Wapiti series of aircraft.

Your coverage of this particular type seems excellent but I should like to have seen some reference to its wartime duties as a target-towing aircraft—a task it still seemed to be performing in late 1942.

The last Wapiti I can recall seeing was over Exeter on October 7th, 1942 (a target-towing variant, as mentioned above), and I should be interested to know if anyone noted this type flying after that date.

In addition, I believe it is not generally known that some of the early Whirlwinds in operational service had strut-braced tail-planes instead of the more familiar "acorn," and also seemed to have .303 Browning armament. As far as I can remember a flight of these machines was operating from Exeter Airport in late 1940. Perhaps other readers can add more to the topic of these unusual variants of Whirlwind.

Westbury-on-Trym, Bristol. P. H. DOBBS.

The Benefits of Security?

FREQUENTLY and unfavourably commented upon is the secrecy employed in official matters. It is, therefore, fitting to relate a perfectly true and verifiable story which goes to prove that, just by the strictest application of security measures, immense benefit can be derived for aeronautical progress.

Our story concerns one of those documents of collected official aeronautical wisdom—in this case the German equivalent, 1914-18, of A.P.970—in which Authority laid down the technical requirements for the design and the construction of military aircraft. The said German document, styled "BLV," was, of course, "top secret" and firms were compelled to take the strictest precautions to make sure that no unauthorized person ever gained access to it. Thus, each time the administrative manager of a certain well-known German aircraft firm was supplied with a copy of the latest edition of the "BLV," together with exhortations to keep it a military secret and with advice as to the penalties involved by disclosing it carelessly, he felt that his patriotic duty demanded that he should shut this dreadfully dangerous document away in the firm's safe. Consequently, neither the designer of the firm nor the eminent engineering pilot who headed the firm (and who was, please note, of non-German nationality) had any inkling of the existence of the said Design Requirements for Military Aircraft—at any rate, not until the firm's safe was emptied after the war was over.

The designer, in the meantime, produced a number of fighter aeroplane types which, though grossly contravening basic technical requirements of the "BLV," were not only adopted for operation but formed, indeed, the best fighter types employed during World War I. Particularly notable were among them the Fokker triplane, the Fokker "Flying Razor" parasol and the Fokker D.VII (used till 1930 for meteorological reporting).

The basic requirement which the designer, Reinhold Platz (responsible for all Fokker designs till 1931), innocently and ignorantly violated with persistence was the strict prohibition of welding in any vital part of the aircraft structure (valid, too, in this country till about 1931).

Had Herr Platz known of the "BLV" and complied with its provisions (which, no doubt, he would have done), welding would have little or no standing here or abroad, and welded steel-tube fuselages would have remained practically unknown.

It pays to observe security, you see!

Dunstable, Beds. A. R. WEYL.

YC-133 Forecasts

MAY I cheerfully challenge the letterpress accompanying the picture of the forthcoming Douglas YC-133 military cargo-personnel transport on p. 439 of your April 8th issue? You state that this is "the first picture to be published in this country of the YC-133," but if you will refer to a contemporary dated May 7th, 1954, you will see a somewhat similar reproduction of an artist's impression from the *Los Angeles Times*. I imagine that both pictures had their origin in a disclosure made at a Douglas stockholders' meeting early last year, at which time, I believe, a preliminary design model was exhibited.

And, quite obviously, the technical data cited from your Japanese source is slanted towards the hyperbolic, for I do not think that even Douglas designers have so polished up their aerodynamics as to contemplate flying a 396,000-lb giant on four P. and W. T-34 5,700 e.s.h.p. turboprops, i.e., with a take-off power loading of 17.4 lb/h.p. In this under-powered condition it would almost certainly run out of runway—or else require the installation of an expensive battery of JATO bottles.

It is perfectly true that the T-34 *was* officially listed as the powerplant of the YC-133, but judging from the big size of the engine nacelles in your Japanese print, I suspect that something much bigger than the T-34 is in the prop-wash, possibly dual-coupled T-34s or Curtiss-Wright 10,000 e.s.h.p. T-47s now under test in a Boeing B-47 airframe. On the basis of an optimistic seven-year development period for a turboprop in the U.S.A., the YC-133 seems unlikely to achieve the production line until after 1962. Before that time, one can expect the ducted turbo-fan or by-pass turbine to offer cargo transport designers a much better chance of exploiting higher lift/drag airframes, for with a fully submerged powerplant there is no aerodynamic reason whatever why the parasitic box-car cargo hold should not be blended into the wing.

Santa Monica, U.S.A. STANLEY H. EVANS.

[The artist's impression from the *Los Angeles Times*, to which our correspondent refers, crudely depicted a four-engined, high-wing transport which might be held remotely to resemble the YC-133's outline today. The picture in our issue of April 8th was, we still believe, the first published in this country which illustrates at all faithfully the features of the big new Douglas transport.—Ed.]

RECENT APPOINTMENTS IN THE INDUSTRY

AN unusually large number of appointments, promotions and retirements in the aircraft and allied industries are having effect at the present time. Several recent announcements are briefly summarized below; further details of some of these appointments will appear in a forthcoming issue.

* * *

The Board of Dowty Nucleonics, Ltd.—the new title of the firm of Davis, Wynn and Andrews, recently acquired by the Dowty Group—is to consist of Messrs. G. H. Dowty (chairman), E. J. Nicholl, L. T. P. Banbury and T. D. H. Andrews (technical).

* * *

Mr. Timothy Ellis has been appointed an assistant secretary to the General Electric Co., Ltd.

* * *

Mr. J. W. Moore, technical manager of Silentbloc, Ltd., Crawley, Sussex, has been appointed general manager of the company.

* * *

After the British Industries Fair (May 2nd-13th)—now a commercial enterprise—Mr. Kenneth Horne will become full-time managing director of British Industries Fair, Ltd. He gives up his post as sales director of Triplex Safety Glass Co., Ltd., after 27 years with that company.

Maj. H. Hemming, A.F.C., F.R.Ae.S., has been appointed chief liaison officer to Burnley Aircraft Products, Ltd.

* * *

Mr. H. J. Armstrong, manager of the B.T-H. Coventry Works, has retired, and Mr. E. G. Crossling (assistant manager) succeeds him.

* * *

Mr. Leslie T. P. Banbury has been made a director of Dowty Equipment, Ltd., and his former post as secretary has been filled by Mr. Kenneth A. N. Mills. He remains secretary of the parent company, Dowty Group, Ltd.

* * *

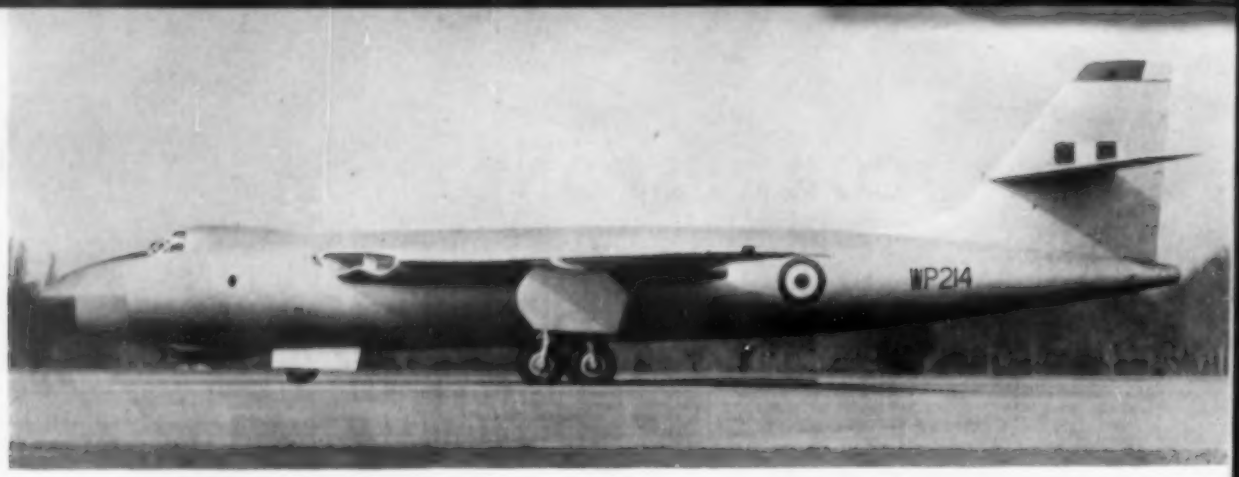
Mr. Frank Banfield, general manager of the Expanded Metal Co., Ltd., becomes managing director in succession to Lt-Cdr G. C. Hans Hamilton, who remains chairman.

* * *

Mr. A. H. Manser, A.F.R.Ae.S., M.I.P.E., M.P.O.A., has been appointed chief buyer of the Bristol Aeroplane Company's engine division, in succession to the late Mr. David Crombie.

* * *

Mr. D. J. Saunders, B.Sc., A.F.R.Ae.S., formerly engaged on rocket development with the M.o.S., has joined the Compoflex Co., Ltd., as chief development engineer (hydraulics).



Characteristically nose-down, a Valiant B.1 (the first B.1 was WP199) is seen here about half-way along its take-off run. With over 40,000 lb of Avon-thrust available, Valiants can operate from any normal-length runway.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Exercise Sky High

DURING this week the Canberras of Bomber Command have been (and in later phases still are) taking part in a major exercise called Sky High. From Monday till yesterday they have been attacking targets in West Germany, Northern France, the Low Countries, and Southern Norway, with interceptions by fighters of 2nd and 4th A.T.A.F.s and the Royal Norwegian Air Force. The bombers were practising their rôle in support of S.H.A.P.E. After the end of the exercise proper, Bomber Command is due to continue bombing practice on ranges in England and Germany until tomorrow, and Fighter Command will make interceptions. Also taking part are aircraft of the 49th (tactical) and 7th (strategic) Air Divisions, U.S.A.F.

During the first phase night intruder sorties were also to be flown against bomber bases; P.R. Canberras were to be active and Lincolns were to simulate minelaying. Fighter Command and the Control and Reporting organization are to be active in this last phase, and bomber stations have held airfield defence exercises.

Good Shooting

FOR the ninth year in succession the R.A.F. has won the Inter-Services Rifle Competition, and set up a record score to boot. They gained 7,937 out of a possible 8,000, beating their previous record by eight points and the runners-up, Territorial Army, by 22.

Hunters in Germany

ONE of the 2nd T.A.F. squadrons at Jever, in Germany, is the first to receive Hunters. Its pilots are at present converting on to Hunter 4s, which they will fly in the same dual-purpose interception/ground-attack rôle as the Venoms and Sabres flown by other squadrons.

New Honorary A. Cdre.

IT is announced that A. Cdre. Finlay Crerar, C.B.E., A.D.C., is to be honorary air commodore of No. 612 (County of Aberdeen) Sqn., R.Aux.A.F., and of the associated units, No. 2612 L.A.A. Regiment Sqn. and No. 3612 F.C.U. Sqn.

A. Cdre. Finlay Crerar was the first commanding officer of No. 612 Sqn., from 1937 until 1939; he was previously a member of the City of Aberdeen Anti-Aircraft Company, R.E. (T.A.), and during the war was appointed Commandant of the Royal Observer Corps. In 1950 he became Inspector of the Royal Auxiliary Air Force, a post which he relinquished in 1951.

Manning Appointment

IT is announced that A. Cdre. W. C. Sheen, C.B., D.S.O., O.B.E., has been appointed Director-General of Manning. He will assume the acting rank of air vice-marshal.

Since January 1952, A. Cdre. Sheen has been Assistant Commandant at the R.A.F. Staff College and he attended the 1951 course at the Imperial Defence College. During the early part of the last war he commanded Nos. 106, 49 and 61 Squadrons and it was while serving with No. 61 that he was awarded the D.S.O.

Spitfire JMR

THE Spitfire 16 (JMR, serial SL 721), flown by Air Chief Marshal Sir James Robb before he retired in 1951, has been acquired by Mr. F. M. Wilcock and is to be permanently on display on the forecourt of Swandean Garage, Durrington, Sussex. The new owner of the Spitfire is a member of the Veteran Car Club and it is therefore to be expected that he will fully appreciate the historic value of his aeronautical acquisition.

H.M.S. "Leopard"

THE third of the new-type anti-aircraft frigates, H.M.S. *Leopard* is to be launched by Princess Marie Louise at Portsmouth on May 23rd.

These anti-aircraft frigates are designed for the protection of convoys and are armed with four 4.5in guns, two small additional guns and a Squid anti-submarine mortar. The gunnery control and gun mountings are similar to those fitted in the *Daring* class ships.

Australian Naval Air Re-equipment

THREE squadrons of the Royal Australian Navy's Fleet Air Arm are to be re-formed in the United Kingdom this year. They are No. 808, which will replace its Sea Furies with Sea Venoms, and Nos. 816 and 817, which will receive Gannets instead of Fireflies. The new fighter squadron will work up at R.N.A.S., Yeovilton, and the anti-submarine squadrons at Culdrose and Eglinton. When ready, the units will embark in the new R.A.N. carrier H.M.A.S. *Melbourne* which is now being converted and is to be commissioned in November. *Melbourne* will have the angled deck and mirror landing aid, and is expected to arrive in Australia next May.

The present R.A.N. carrier *Vengeance*, which is on loan from the Royal Navy, will leave Sydney for England on June 16th, and when she is returned to the Navy her Australian crew will take over *Melbourne*.

New Darwin Airfield

CONSTRUCTION work is soon to start on a new air base at Darwin in the Northern Territory of Australia. It will be the largest in Australia, will take two years to build, and will be constructed by the Works Squadron of the R.A.A.F. which has just completed a runway at Williamtown, N.S.W. The cost is estimated at £A3,000,000.

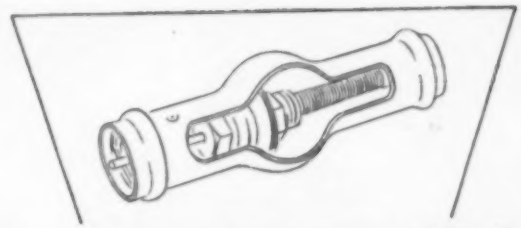
R.A.F. Yacht Club

FURTHER details of the R.A.F. Yacht Club's open Firefly meeting on August 13th-14th have been announced. Tankards will be presented to the helmsman first home in the following categories: university students (including Service cadets); boys and girls at schools with sailing clubs; and other boys and girls. Details are obtainable from The Secretary, R.A.F. Yacht Club, Riverside House, Hamble, Southampton.

Reunion

THE annual reunion of No. 619 Squadron, to be held on May 14th, will again be at the "Magpie and Stump," 18 Old Bailey, London, E.C.4. Particulars from Mr. P. S. Osborne, c/o. A. R. Heathcote and Company, Ltd., Bernard Works, Sylvester Gardens, Sheffield 1.

Air Marshal Sir Harry Broadhurst, C-in-C. 2nd T.A.F., presents the Duncan Trophy for air-to-air gunnery training to S/L. W. J. T. Henderson, commanding officer of No. 266 (Rhodesia) Squadron, the winning unit.



The Non-Return Valve

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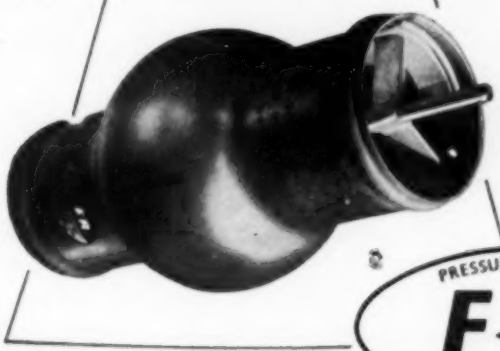

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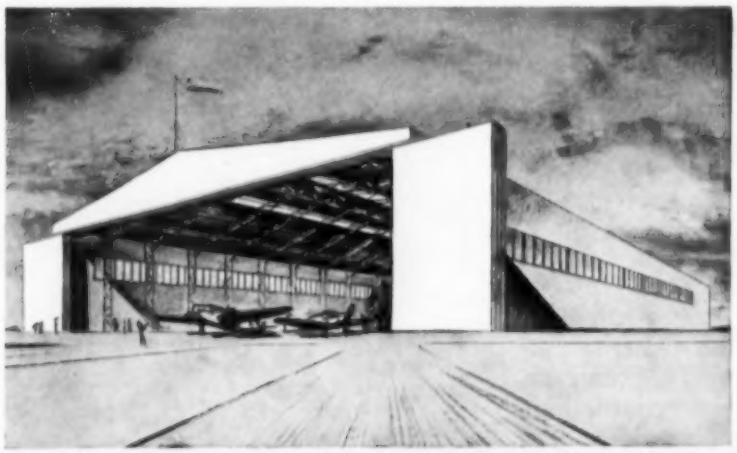

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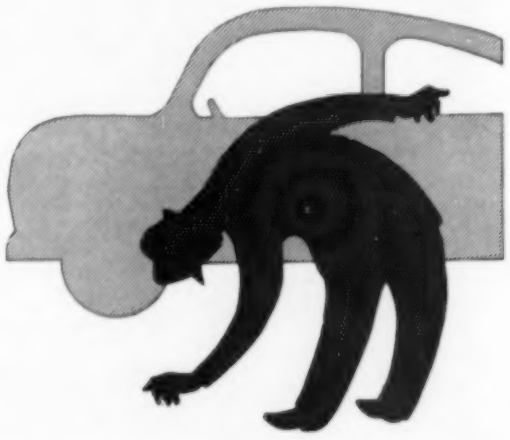

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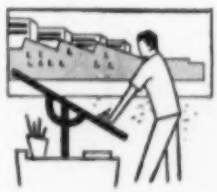

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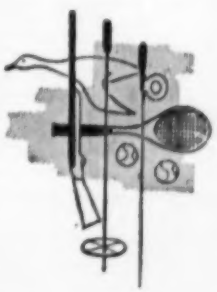

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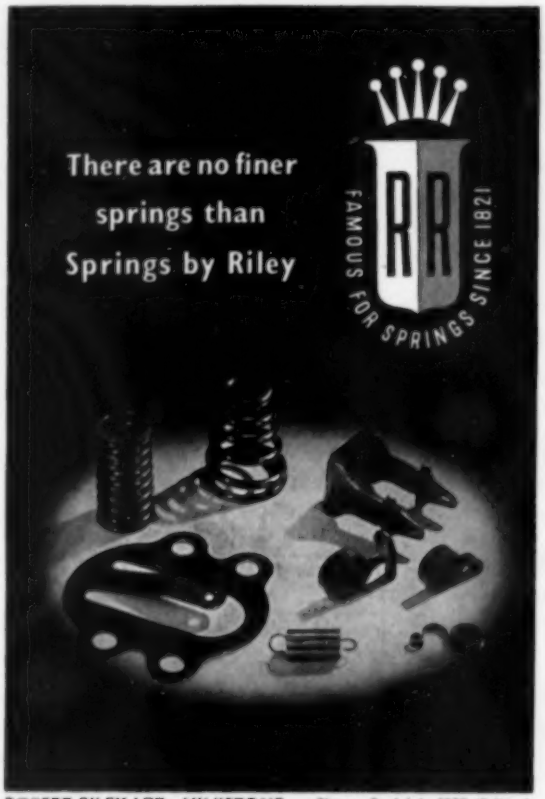

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THIS application will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to this application must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the application may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [3644

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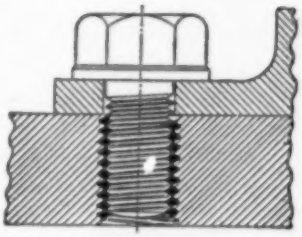

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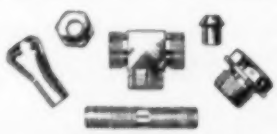

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